THE MARINE REVIEW

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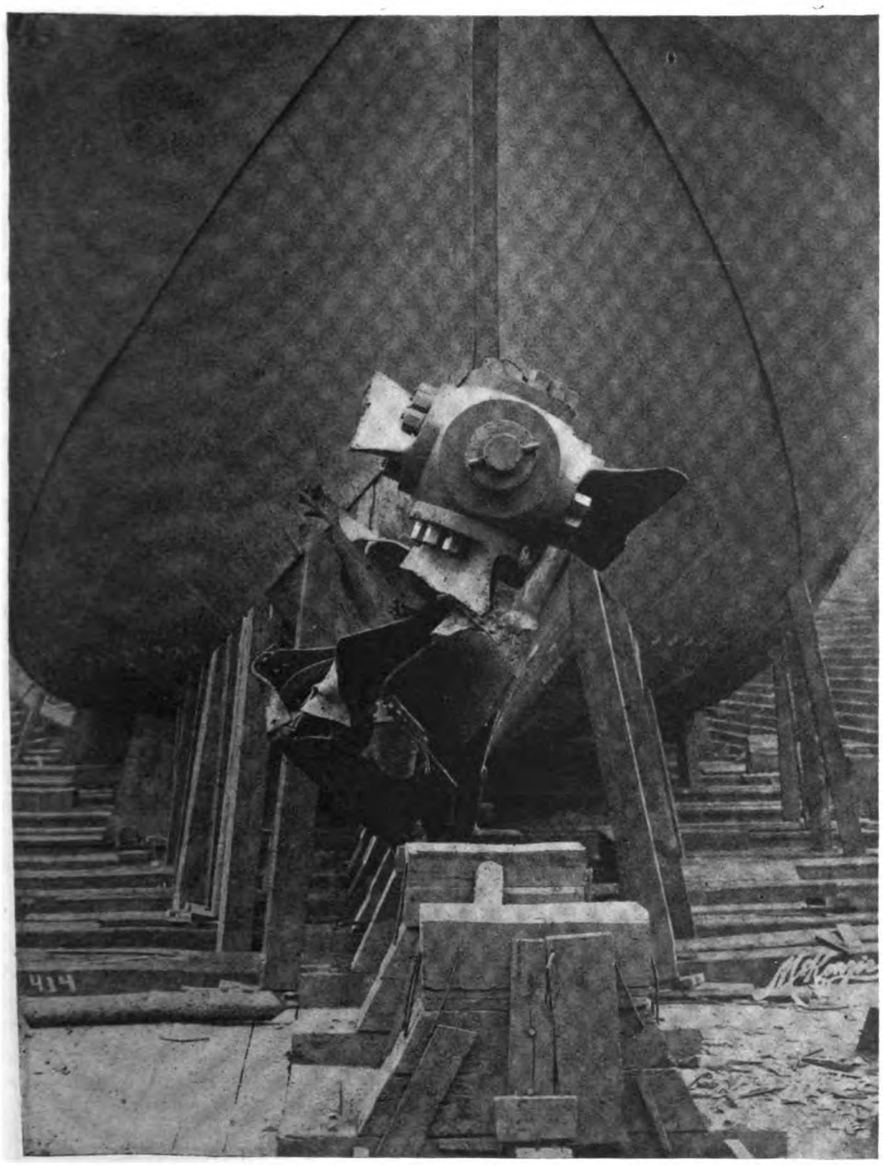
THE MATAAFA IN DRY DOCK.

The accompanying pictures, just taken of the Mataafa as she stands in the dry dock of the Superior Ship Building Co., show something of the damage sustained by the boat. A great deal of work must be done on her and just how long it will take cannot be estimated with certainty. She is to have a new stem and new stern post. A new rudder has been ordered and the broken propeller will have to be replaced. Nearly all of the framing will have to be taken out, as it is badly bent and strained. Two-thirds of the tank construction must be taken out and replaced. When the Mataafa was brought into the ship yard before getting her into dry dock, she nearly broke in two again. In lightering her the ore had all been taken out except in the middle section where the break had occurred in order to keep all the buoyant forces in compression on the beams holding the break together. Toward the last when even the ore in the middle was being removed and the weight was being taken off the bottom the break started to open and the Mataafa had to be rushed into the dock.



STERN VIEW OF THE MATAAFA IN DRY DOCK.

SKETCH OF MAJOR GRAHAM D. FITCH.

Major Graham D. Fitch, who has succeeded Major Potter as government engineer at Duluth, has seen service in many capacities since being graduated from the naval academy in 1882. After acting as assistant to various officers of the corps of engineers, including a term of service at Duluth in 1890 and 1891, lieutenant and later Captain Fitch was placed in charge of the first and second districts of the Mississippi river with headquarters at Memphis, Tenn. He was then transferred to the military post at Willet's Point, New York harbor, where he remained in command of company "C," battalion of engineers, until the outbreak of the Spanish-American war. During the Santiago campaign, in which his company participated, Captain Fitch had command for a part of the time of the battalion of engineers and served with the volunteer rank of major.

After the war Major Fitch was assigned to duty at St. Louis as secretary and disbursing officer of the Missouri river commission, following which he was transferred to Oswego, New York, to take charge of the harbor improvement work on Lake Ontario. The last position Major Fitch held immediately preceding his coming to Duluth, was at Little Rock, Arkansas.

NO OCEAN-GOING AMERICAN BOATS.

That a licensed American officer is restricted in looking for a berth to the great lakes, is a declaration made by Capt. John Tower, of the Peavey steamer Frank T. Heffelfinger, at Ashtabula last week. Capt. Tower has sailed on the ocean more than he has on the lakes; in fact, he has sailed to all parts of the globe.

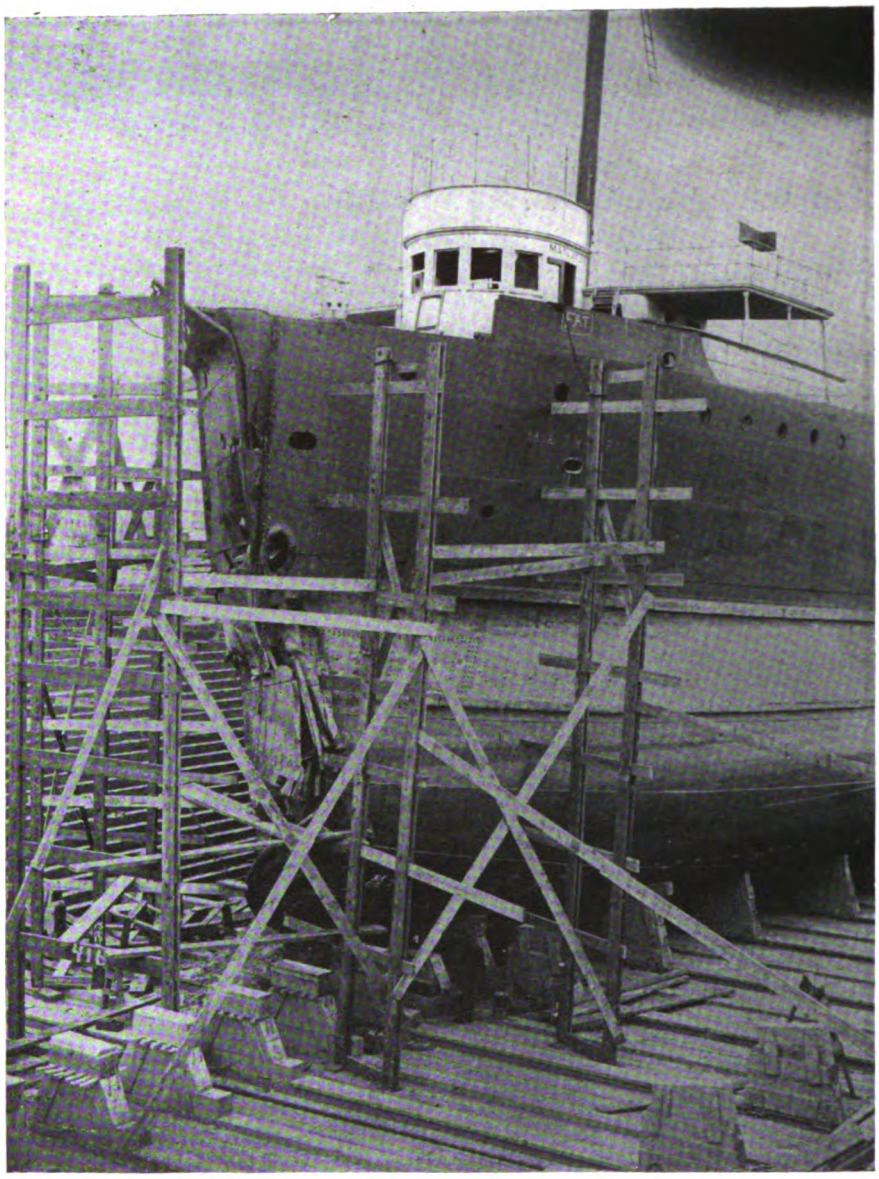
"An ambitious youth today with inclinations to grow up aboard ship and succeed at the business by climbing to the top, can not get work on the ocean," he said. "It sounds funny, but it is a fact that there are no ocean-going American boats, and the few coasters are filled up.

"When I was master of the steamer Northwestern, which plied between the lakes and Hamburg and Antwerp, I was surprised by the American consul at Antwerp on my first trip. He came to me and told me he was glad to see my boat, because it was the only one flying the stars and stripes that had put in there.

"With a merchant marine of our own, the young men in the country could look forward to bright things. They could ship out on an ocean-going boat and work up to lucrative positions. As it is now, the lad who wants to go to sea must work out the best years of his life on foreign ships and then when they benefit by their experience and get their papers, face the stern reality that they can never get a boat to sail."

Captain Tower started sailing when he was sixteen on fruit packets out of Boston. He afterwards went on the fast clipper ships, and at an early age for most men had been on both the Atlantic and Pacific oceans. He says he wanted the experience, and he admits gaining a lot of it.

"My license as a salt water skipper is no good to me, because I am an American, and there are no American boats," he concluded.



BOW VIEW OF THE MATAAFA IN DRY DOCK.

SCHERZER ROLLING LIFT BRIDGES.

American railway engineers and managements are noted for their progressiveness. They are constantly seeking to improve and modernize their railways and readily adopt successful improvements to increase the efficiency, safety, and economy of operation.

The extended use and wonderful success of the Scherzer rolling lift bridges is principally due to the fact that the value of the many advantages of this modern type of bridge have been quickly recognized and availed of by the engineers and managements of the leading railroads.

The complete success of the four-track Scherzer rolling lift bridge completed in 1895 at Chicago for the Metropolitan Elevated Railroad Co. caused the engineers and management of the New York, New Haven & Hartford railroad to adopt this modern type of bridge for construction at the entrance to their new South Terminal station, Boston, where six tracks had to be accommodated across Fort Point channel. If a six-track swing bridge were built, all the tracks would have to be built on one movable structure. Any injury to the structure would tie up the railroad traffic at this important station. With the Scherzer rolling lift bridge the six tracks could be accommodated by building three double-track Scherzer rolling lift bridges side by side to be operated either jointly or separately, as desired. Injury to one bridge would not interfere with traffic across the remaining bridges. The speed of operation, safety, economy and efficiency demonstrated by this large bridge induced the same railroad company to decide to remove its center-pier swing bridges at Bridgeport, Conn.; Westport, Conn.; Cos Cob, Conn.; Housatonic river, Conn.; Connecticut river, Conn.; Bronx and Hutchinson rivers, New York, and Neponset river, Mass., and replace them with modern Scherzer rolling lift bridges, each accommodating four to six tracks, the four and six-track bridges each formed of double-track bridges placed side by side. Whenever the traffic of the railroad increases and requires additional parallel tracks and bridges, they can be readily added without interfering with the existing traffic or bridges as they can be built alongside of each other to carry any number of

parallel tracks desired. This advantage is lost when a swing bridge is built. To provide additional tracks to accommodate growing traffic, the swing bridge must be removed at great losses and replaced by a new and wider and longer structure.

The numerous advantages of the modern Scherzer rolling lift bridge were recognized in 1898 by the interested railroad companies in the adoption and construction of the eight-track bridge of this type consisting of four double-track bridges across the sanitary and ship canal at Chicago instead of a center-pier swing bridge. The companies using this very large bridge are the Pennsylvania lines, the Baltimore & Ohio railroad, the Chicago Terminal Transfer railroad and the C. J. railroad.

The C., C., C. & St. L. railroad was the first to adopt a Scherzer rolling lift bridge for construction at Cleveland to supersede a center-pier swing bridge. The success of this bridge soon led to their decision to adopt this modern type of bridge to take the place of their double-track main line bridge at Cleveland. The new bridge was constructed and placed into service without requiring a temporary bridge or diverting or delaying the railroad traffic. This could not be accomplished with a swing bridge or any other type of movable bridge.

It was this advantage that first attracted the attention of the engineers and management of the South Eastern & Chatham railroad, England, and led to the adoption of a Scherzer rolling lift bridge which has been constructed and placed in successful operation on their main lines across the Swale river, England.

The success of the Scherzer rolling lift bridges constructed for the Big Four railroad induced the Newburgh & South Shore Railroad Co. to adopt this type of bridge for constrution on their lines across the Cuyahoga river where a single-leaf movable span 160 ft. long was required. This bridge has been in successful operation for several years and is being duplicated by the Baltimore & Ohio railroad at Cleveland and also by the New York, Chicago & St. Louis railroad, both companies replacing their center-pier swing bridges. The Baltimore & Ohio railroad is also constructing at Cleveland, to take the place of a swing bridge, a single-leaf Scherzer rolling lift bridge having a movable span of 230 feet. The two double-track Scherzer rolling lift bridges constructed for the Central Railroad Co., of New Jersey, have been in successful operation for several years.

Among recent orders are two double-track bridges for the Norfolk & Western railroad, having movable spans of 145 and 160 ft. respectively. These bridges are designed to carry the heaviest engine loadings. More than 60 additional railroad, electric railroad and highway Scherzer rolling lift bridges have been constructed and placed under construction in the United States.

Many of the leading foreign railroad companies are also progressively modernizing their lines and adopting Scherzer rolling lift bridges. The Scherzer rolling lift bridge across the Suir river, Ireland, for the Fishguard & Rosslare railways is nearing completion; the Buenos Aires Great Southern railway is building two double-track Scherzer rolling lift bridges at Buenos Aires, Argentina. The Dutch railroad is building a Scherzer rolling lift bridge across the Spaarne river, Holland, on their main line fast mail route.

Among recent foreign orders secured by the Scherzer Rolling Lift Bridge Co. are:

One by cable from the government at Khartoom, Egypt, for a duplicate of the large double-track Scherzer rolling lift bridge built for the Newburgh & South Shore railroad, Cleveland; also an order from the Burma railways for a long span Scherzer rolling lift bridge to be constructed across Ngawun river, India; also an order from Sir Benjamin Baker for the new Buccleugh bridge, Barrow-in-Furness, England. Substantial progress is also being made in the construction of the Walney island bridge, England, and the Ekaterinhofka bridge, Russia.

For all of these bridges the Scherzer Rolling Lift Bridge Co., Monadnock Block, Chicago, furnish the designs, plans and specifications and consulting engineering services, co-operating with the engineers of the various railroad companies, governments and municipalities.

The above record includes the largest and most important railroad, electric railroad and highway movable bridges constructed throughout the world during the past ten years. It is an unparalleled record, as all of the bridges constructed have been eminently successful and have resulted in repeated orders.

The successful solving of the many large and important problems connected with the design and building of so very vital a structure as a movable bridge demands the services and most extended experience of the highest order of consulting engineering specialists. This is demonstrated by the numerous expensive experiments with swing bridges which have delayed and endangered traffic and in many cases, after only a few years of service, have had to be removed and replaced by modern efficient bridges. Attempts at experimental movable bridge construction are especially expensive, one recent instance being a single-track railroad, trunnion bascule bridge constructed at Cleveland, Ohio. The first cost of this bridge was very high and it had only been placed in operation a short time when, owing to the complicated character of the structure, the great friction and other faults developed made it unsafe to operate the bridge, compelling the abandonment of all trains in and out of the terminal station and across the bridge for several weeks, while temporary repairs were being made to the bridge.

GAS BLOWING ENGINE PLANT.

What will eventually develop into perhaps the largest gas power plant in the world has its inception in an important contract recently placed with the Westinghouse Machine Co., of East Pittsburg, for eight large gas driven blowing engines to be installed in the steel plant at Gary, Ind. As it is the expressed intention of the United States Steel Corporation, which controls the Indiana Steel Co., to make this the foremost American steel center, the significance of simultaneous development of gas power is obvious.

The machines comprised in this initial order will be uniform in size and capacity. Each gas engine, as an electric unit, will have a rated capacity on blast furnace gas of nearly 3,000 H. P., corresponding to a rating of 4,000 H. P. on natural gas. The unit will be arranged in twin tandem fashion, each side consisting of two double acting gas cylinders and one blowing cylinder in the opposed or "vis a vis" arrangement. Power cylinders are 42 in., and the air cylinders 68 in. in diameter with a common stroke of 54 in., the unit running at a maximum speed of 75 R. P. M. for blowing and 84 R. P. M. for electric work. The capacity of air delivery at this speed will be 33,000 cu. ft. of free air per minute at 18 lbs. pressure, with a maximum pressure delivery of 30 lbs. per square inch.

This type of engine will not only be used for blowing purposes but also for electrical generation. In all sizes a resemblance to the horizontal tandem heavy duty steam engine design is strong.

AROUND THE GREAT LAKES.

The steamer, William C. Pollock, carried 7,002 tons on her maiden trip. This is really excellent, as the Pollock is classed as a 6,500-ton ship.

The steamer, Monkshaven, which was wrecked on Lake Superior in the great November storm of last year, has been floated and will be dry docked at Duluth.

The steamer, Bulgaria, which went ashore on Fisherman's shoal, Green Bay last June, has been released and has been taken to Manitowoc for repairs.

The passenger steamer, Lucille, sank in Lake Erie, off Toledo, last week. When it became apparent that the steamer would sink, the crew took to the life boats.

The Northern Navigation Co., Sarnia, Ont., has purchased the package freighter Cuba, from Oliver G. Donaldson, Buffalo, and has changed her name to Ionic.

The Pittsburg Steamship Co.'s steamer, Mariska, left the floating dry dock at the Great Lakes Engineering Works plant last week. Extensive repairs were made to her.

The steamer, Orinoco, of the Davidson fleet, has been given new decks, new deck beams and new bulkhead and engine hatches, at Davidson's ship yard at Bay City.

R. O. and A. B. McKay, of Hamilton, Ont., have purchased the freight steamer, Winonah, for the upper lake trade. The Winonah left Sidney, Cape Breton, for Hamilton last week.

Anthony Lawrence, formerly second mate on the Gilchrist steamer George F. Williams, has shipped in the same capacity on the steamer Samuel Mitchell with Capt. William Hagen.

The local inspectors at Port Huron who have investigated the sinking of the Canadian steamer Erin in St. Clair river on the morning of May 31 by the steamer John B. Cowle, have found the Cowle to be blameless.

On her maiden trip the steamer Ishpeming, of the Cleveland-Cliffs fleet, carried 10,104 gross tons of ore from Marquette, breaking the harbor record for that port. The Ishpeming drew 19 ft. one inch forward and 19½ ft. aft.

The steamer, Rochester, which was purchased by Mayor S. C. McLouth and others, of Marine City, has been fitted with new steam steering engines, new mooring engines, and other minor machinery, at Kenyon's yard, Marine City.

Major W. B. Judson warns vessel masters entering the harbor of Waukegan to keep 40 ft. from the harbor face of the pier while entering or leaving the port, in order to avoid the stone temporarily placed alongside the pier.

Jans Johnson, one of the oilers on the steamer Alexander McDougall, expects to attend the Armour Institute at Chicago when his boat lays up. It is probable that his partner, John Schei, will also attend. They are both studying engineering.

Geo. L. Phillips, now mate on the B. Lyman Smith, is to leave her next trip to go mate on the new Becker steamer Joshua Rhodes with Capt. F. G. Simmons. Frank Edwards, now ashore, is to ship on the same boat as second mate.

The old steamer, Joseph L. Hurd, sprung a leak in the heavy seas off Grosse point last week and became water-logged. The crew was taken off by the Western Transit liner, Mohawk, and taken to Chicago. The Hurd was towed into port.

J. W. Patterson, who was chief engineer on the steamer Hennepin, is acting as first assistant on the steamer Michigan. George Laird is the second. John McMonagle, formerly on the J. H. Wade, is her chief engineer, taking hold on the last trip to Ashtabula.

Fred Waxham, of Erie, who has been oiling on the steamer James Laughlin, got off at Ashtabula this week to see his mother who was reported very near death. Bernard Bennett, brother of the mate, who has been watching, left her to return to his home at Corunna, Ont.

Capt. P. L. Millen, formerly master of the steamer Powell Stackhouse, was in Ashtabula last week. He went from there to Conneaut to look over the J. Pierpont Morgan, practically a duplicate of the Mahoning Steamship Company's 602-foot steamers Morrell and Townsend.

The steamer, J. H. Pauly, drifted down the St. Clair river last week a mass of flames. When the hulk finally went ashore two miles below Marine City, it had been destroyed to the water's edge. The steamer was at Sickens dock at Marine City when the fire broke out. She was owned by C. W. Kotcher, of Detroit.

The Great Lakes Engineering Works, of Detroit, did a quick job in repairing the steamer L. C. Smith. She stranded in St. Mary's river and it was necessary to remove sixteen plates and twenty-five broken frames. All the plates except three were rerolled and put back, the steamer being in dock seven days.

John B. Allair, of Port Huron, who was second mate on the steamer H. L. Shaw the first part of the season, has been given a mate's berth on the whaleback steamer Henry Cort. He came in on his first trip to Ashtabula Tuesday. Mr. Allair and Captain John A. Ferguson, master of the Cort, both joined the ranks of the benedicts last winter.

Col. S. C. Reynolds, of Toledo, has sold his fine steam yacht Sigma to Geo. L. Craig, who purchased her for the Arnold Transit Co. Col. Reynolds will have another yacht built and will equip her for ocean service. Capt. Beach and Engineer Cady Markley will bring out the new boat in the spring, both having had charge of the Sigma.

At the annual meeting of the Manitowoc Dry Dock Co., Manitowoc, Wis., the following officers were re-elected: Elias Gunnell, president; Thomas J. Prindeville, vice president; L. E. Geer, secretary and treasurer; Charles West, superintendent. A dividend of six per cent was declared. It was decided to abandon the negotiations for the purchase of the plant of the Empire Ship Building Co., Buffalo.

According to indications, the article on "Reckless Navigation" in the last issue of the MARINE REVIEW, relating to line captains, created no end of attention among the captains on ore carriers. All the skippers trading into Ashtabula, steel trust and others, insist that they never knew a line master to check, even when they are going over the crossing with a deep-laden ore boat coming down at the same time.

Many steamers plying up and down the lakes have mascots of some sort, but it is doubtful if any can compare with the one on the Heffelfinger in the shape of a wolf dog. The dog's name is Duke and he belongs to the master, Capt. John Tower. He is three-quarters wolf and one-quarter dog. Men on business are never molested by Duke when they seek the captain, but anyone bent on mischief would have his troubles.

The control of the famous section 30 property on the Vermillion range, which from time to time many interests have endeavored to possess, but abandoned later, owing to the high figure at which the property was held, has finally passed to the Midland Steel Co., of Pittsburg. The terms of the transfer are not known, but the deal is highly important, as the section is thought to contain about 10,000,000 tons of ore.

Officials of the United States Transportation Co. made a shift on the after end of the steamer Harry Coulby at Ashtabula last week. Mr. C. Wiltoncox, first assistant engineer on the Coulby, went out on the Wilkinson as second engineer as far as Toledo, where he

made another shift to the Nottingham as her chief. William Davidson, of the Wilkinson, succeeded him. The reason for the change was the resignation of John Courtney, as chief of the Nottingham.

Gale A. Dull, of Detroit, Mich., who is a junior in the literary department of the University of Michigan, is decking on the Cleveland-Cliffs Iron Co.'s steamer Michigan. He took the place of Floyd Rowe, of Battle Creek, Mich., who is in the engineering department. Both young men have wealthy parents and they are steamboating for experience. The Michigan brought down 10,307 tons of ore the last trip on a 19-ft. seven-inch draught.

The Mitchell steamer Moses Taylor is seen in the accompanying picture. She was on her first trip down in the spring when she was snapped just above the locks at the Sault. She had 5,840 tons of ore for her first cargo. The picture was taken at 7 a. m., April 24, and the reflection in the water is remarkable for that reason. The Moses Taylor is commanded by Capt. Fred D. Galton. Mr. S. H. Smith and Mr. F. E. Dana being first and second mates. John D. Riley is chief engineer.

The appeal to Supervising Inspector C. H. Westcott, made by Norman W. Gibson, of Buffalo, the pilot of the steamer Starucca, which grounded on South point near Milwaukee on April 26, has been denied. The sentence of ninety days' suspension, passed by the local inspectors of the United States at Milwaukee, is sustained. It appears that Gibson ran the boat through the fog for several hours, without making any soundings or waking the captain to inform him that the weather was thick.

One of the most remarkable features of this navigation season has been revealed at Lake Erie ports by the statements of the mates on the big boats. One and all are agreed that the skippers and owners are crowding the boats, as well as the mates, almost to the limit, but they all appear satisfied and do not complain. With boats making four trips a month in some cases, the mates are called on for long watches which are extremely frequent, but they seem to take pride in telling how many trips their boats make and they do not even think of kicking on the rush.

The wrecking tug which the American Ship Building Co. will build for the Great Lakes Towing Co., from designs by Mr. W. I. Babcock, of New York, will be the largest wrecker on the lakes. She will be 45 ft. longer and 15 ft. wider than the wrecking tug Favorite. The tug will be 196 ft. over all, 180 ft. keel, 43 ft. beam, and 21 ft. deep. Her engines will be triple-expansion, with cylinders 22, 36 and 60 in. diameter by 30-in. stroke; supplied with steam from two Scotch boilers, 15 ft. in diameter and 12 ft. long, allowed 180 lbs. pressure. The tug will be built at Buffalo and will be delivered next spring.

Rev. Loomis Black, a Universalist minister from Watertown, N. Y., has been shipped as a seaman on the Pittsburg Steamship Co.'s steamer John Ericsson by Capt. E. O. Whitney, the skipper on that ship. Rev. Mr. Black is "sailing before the mast" not only for the experience it gives him, but for the health-giving recreation as well. His being on the boat in the capacity he is, however, marks a new era in marine doings. His shipmates say he turns to with such a will, one might think he had sailed all his life. There is nothing he will not attempt to keep things shipshape on board. Mate James G. Herbert and Second Mate George Slyfield say he is a wonderful worker. Rev. Mr. Black is on the deck watch.

THE STEAMER MOSES TAYLOR TAKEN IN THE ICE, SHOWING HER REFLECTION IN THE WATER.

Officers on the steamer Harry Coulby are greatly pleased with the record she has made thus far, Capt. R. J. Lyons being particularly gratified. The Coulby has carried record-breaking cargoes, but she also deserves mention for keeping practically the same crew she started out with. Even the firemen like her, and with firemen scarce, this is saying a good deal. The Coulby brought in 10,520 tons of ore to Ashtabula on her last trip on an even draught of 19:4 ft. Capt. Lyons was disappointed in this, however, because she carried 10,515 on a 19:2 draught earlier in the season. He says he expected she would have more on the deeper draught. Her biggest load was 10,939 tons to South Chicago. No particular effort has been made to fit the Coulby for carrying passengers but it is notable that her owners' quarters are on a par with any boats on the lakes. The woodwork is mostly in heavy panels of a rich but dark color. The ceiling is being paneled. Wesley Rinn and F. B. Parsons are first and second mates on the Coulby.

SUMMARY OF NAVAL CONSTRUCTION.

The bureau of construction and repair of the navy department notes the following progress upon naval vessels in its monthly summary:

Name of Vessel.	Building at	1906: Per cent of com. July 1.	Aug. 1.
BATTLESHIPS.			
Virginia	Newport News S. B. Co....	100.00	
Nebraska	Moran Bros. Co.	95.16	96.
Georgia	Bath Iron Works	97.47	98.43
Connecticut	Navy Yard, New York	97.41	97.66
Vermont	Fore River S. B. Co.	88.5	90.5
Kansas	New York S. B. Co.	85.2	85.8
Minnesota	Newport News S. B. Co....	91.44	93.68
Mississippi	Wm. Cramp & Sons.	59.86	60.83
Idaho	Wm. Cramp & Sons.	58.07	59.
New Hampshire	New York S. B. Co.	48.0	50.3
South Carolina	Wm. Cramp & Sons.		0.
Michigan	New York S. B. Co.		0.
ARMORED CRUISERS.			
California	Union Iron Works.	94.0	94.6
South Dakota	Union Iron Works.	91.8	92.4
Tennessee	Wm. Cramp & Sons.	99.75	100.
Washington	New York S. B. Co.	99.00	100.
North Carolina	Newport News S. B. Co....	50.50	53.87
Montana	Newport News S. B. Co....	44.72	47.66
PROTECTED CRUISERS.			
St. Louis	Neafie & Levy S. & E. B. Co.	98.77	99.22
Milwaukee	Union Iron Works.	96.1	97.9
TRAINING SHIPS.			
Cumberland	Navy Yard, Boston.	95.	95.
Intrepid	Navy Yard, Mare Island...	97.5	97.5
SCOUT CRUISERS.			
Chester	Bath Iron Works.	36.88	40.80
Birmingham	Fore River S. B. Co.	38.4	41.80
Salem	Fore River S. B. Co.	39.3	42.6
SUBMARINE TORPEDO BOATS.			
Submarine T. B. No. 9	Fore River S. B. Co.	75.9	81.7
Submarine T. B. No. 10	Fore River S. B. Co.	62.0	69.3
Submarine T. B. No. 11	Fore River S. B. Co.	72.3	81.3
Submarine T. B. No. 12	Fore River S. B. Co.	59.0	65.1

PERSONALS.

Mr. J. J. Murray has been appointed manager of the Great Lakes Dredging Co. in charge of work in lakes Erie, Ontario and St. Clair, with headquarters at Cleveland.

Mr. Louis C. Sabin, who has been appointed superintendent of St. Mary's Falls canal, will be succeeded as secretary of the International Waterways Commission by Mr. W. Edward Wilson, of Salt Lake City.

Mr. P. A. Cohan announces the dissolution of the partnership as steamship brokers which has long existed between himself and Mr. T. W. Tamplin under the firm name of H. E. Moss & Co. The business will be carried on as hitherto by Mr. Cohan under the name of H. E. Moss & Co. The London office of the company will be at 43 St. Mary Axe and the Liverpool offices at No. 18 Chapel street, and the Newcastle-on Tyne office in the Exchange building.

SAN FRANCISCO COMMERCE.

Some adequate idea of the volume of traffic passing in and out through the Golden Gate may be formed from the recent report of the secretary of the San Francisco Chamber of Commerce. During the year 1905, 429 steamers arrived from foreign ports with a total cargo capacity of over 1,000,000 tons and 323 sailing vessels with over 400,000 tons. There sailed to foreign lands 694 steamers with a capacity of nearly 1,000,000 tons. The increase annually in the value of exports to the orient is over $10,000,000; it amounted to $10,000,000 during 1903, increased to $20,000,000 for 1904, and to $32,000,000 in 1905. The merchandise went principally to Japan, which took $18,500,000; China took nearly $10,000,000; Hong-Kong about $2,000,000; the Philippines $1,250,000, and the remainder in the order named going to Siberia, Corea, the East Indies, Straits Settlement, Siam, Midway Island, Guam and Russian China. The traffic between San Francisco and the Atlantic ports was twice as great in value, the merchandise exported amounting to nearly $65,000,000, and the incoming merchandise at $45,250,000. The traffic has gained steadily during a series of years, notwithstanding that the grain exports have been decreasing.

The steamer, Henry H. Rogers, cleared from Ashland last week with 13,088 gross tons of ore for Chicago.

OBITUARY.

John W. Hedenberg, assistant treasurer of the Merritt & Chapman Salvage & Wrecking Co., died on August 6.

Daniel Mahoney, the senior member of the firm of Daniel Mahoney & Son, Buffalo, died recently. He was at one time engineer for the Great Lakes Towing Co.

Capt. Wm. A. Irvine died at Harper hospital in Detroit recently. He was forty-seven years old and had been sailing since he was seventeen, almost without exception in vessels controlled by McMillan estate. He began as oiler on the steam barge Argonaut, but after the first season went to the deck. In his early twenties he became master of the steamer Iron Cliff and sailed this vessel for two or three years after she was purchased by the Corrigans, of Cleveland. Later he returned to the McMillan employ. His loss is greatly felt by them.

Daniel W. Wilcox, a well known marine man, whose home had been in Buffalo until recently, for 15 years, died in Dutchess county, New York, the night of Aug. 11. Mr. Wilcox was born at Augusta, Ga., forty-three years ago, and when a young man came to Buffalo to make his home. At one time he was connected with the Western Transit Co., but later engaged in marine insurance. He was the junior member of the old marine insurance firm of Smith & Wilcox. Last June he went to New York to engage in business and soon afterward became ill. Six weeks ago he was sent to the Adirondacks to benefit his health. The remains were taken to Buffalo Sunday, and the funeral was held Wednesday, Aug. 15, from the chapel at Forest Lawn cemetery.

Charles Addison Bragg, district office manager of the Westinghouse Electric & Mfg. Co., Philadelphia, Pa., died at that place on Sunday, July 29, after an illness of over two months' duration. Mr. Bragg was one of the pioneers in the electrical business, he having been associated with the United States Electric Lighting Co. as early as 1882. His connection with the Westinghouse Electric & Mfg. Co., began in the year 1889, when he was made the manager of the Philadelphia office, which position he filled successfully up to the time of his death. Mr. Bragg possessed a most genial disposition, which endeared him to all with whom he came in contact. He was born and reared in Franklin county, Missouri. Following his early education, he attended Yale college, from which he was graduated. He was 56 years old. Mr. Bragg is survived by his wife and one daughter.

LAKE SHIP YARD METHODS OF STEEL SHIP CONSTRUCTION.

BY ROBERT CURR.

Fig. 25 shows mold for brackets connecting the arch part of the belt frame to the spar deck.

These bracket plates are flanged to the arch so that the tee-shaped mold serves the purpose of marking right and left.

Fig. 26 shows the mold for deep floors spaced every twelve feet. The dotted lines show the lightening holes which are marked with mold for that purpose.

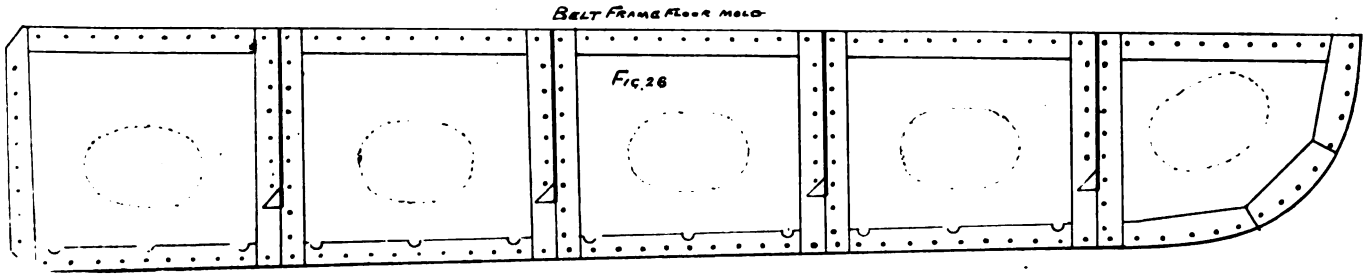
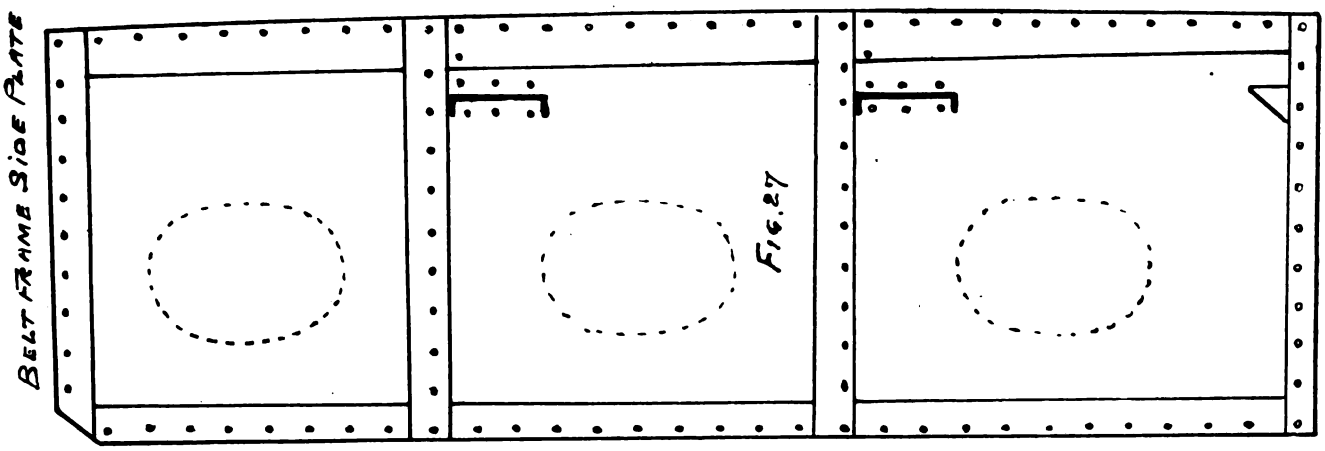


Fig. 27 shows mold for the belt frame connected to the floor. This plate goes from the tank top line to the main deck. The lightening holes are marked with a mold for that purpose, as shown by dotted lines.



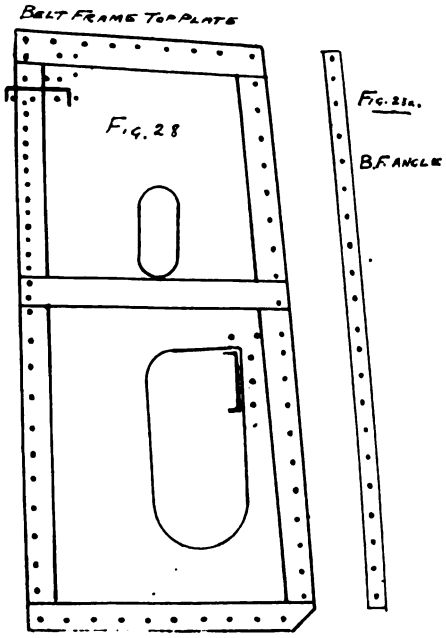


Fig. 28 shows mold for the top part of belt frame which runs from the main deck stringer, or top of side tank, to the spar deck.

Fig. 28a shows a mold for part of belt frame angle which runs between main and spar deck. This frame is cut on top of tank at side to facilitate the fitting of the watertight angles on main deck.

The holes for the shell flange of this angle are obtained from the shell mold, b Fig. 13.

Fig. 29 shows mold for plate at side of arch, two plates for each arch are marked from this mold.

Fig. 30 shows half mold for the center plate of arch. The mold fits to the center line and the holes near same are for bracket plate connecting arch and spar deck together. These holes are for one side of the vessel only which have to be omitted when the mold is turned over.

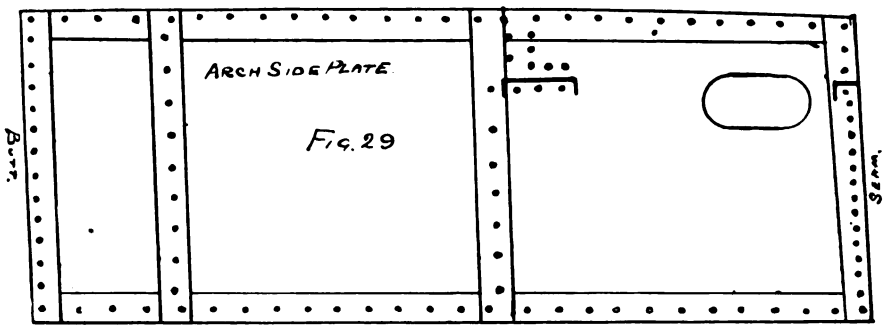


Fig. 31 shows mold for gusset connecting belt and arch together filling in where the face angles turn around on the belt frame.

Fig. 32 shows half mold for face angles on the arch. Double angles run from the top of side tank across the ship connecting to stringer plate on both sides and a plate is riveted on face of these angles as shown by half mold b Fig. 32.

C shows the mold for rivet holes connecting the angles to stringer plate.

Fig. 33 shows mold for tank top intermediate angles. The marks "a a" are squared over and the balance of the holes are marked from the tank top angle mold Fig. 16.

Fig. 34 shows mold for deck angles on the arch plate. "b" shows the mold for deck holes on same.

Fig. 35 shows mold for belt frame angle. This frame angle runs from the center keelson to the main deck. The shell holes are obtained from molds Fig. 13 and 14 as explained.

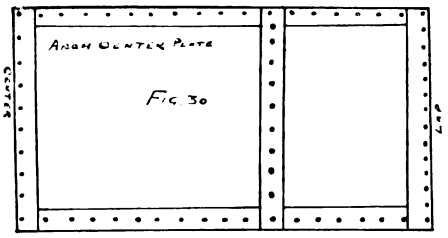
Fig. 36 shows mold for bulkhead plate half way between side and center of ship with stiffeners on sean and center.

Fig. 38 shows mold for vertical stiffeners and Fig. 39 shows mold for horizontal stiffeners.

Spacing holes is sometimes trouble-

some and as it is necessary that the mold work should have a regular spacing, the following method as shown by Fig. 40 is practiced.

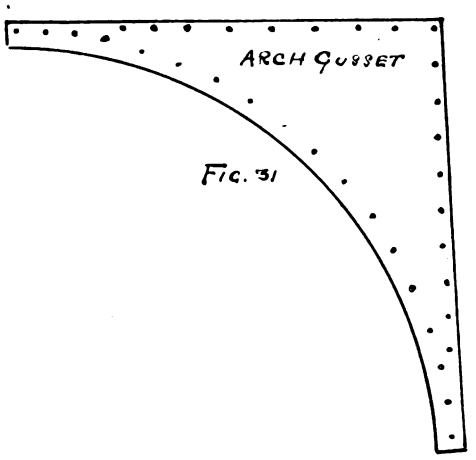
To divide a line into any number of equal parts. Fig. 40. Let A B be the given straight line to be divided into



a number of equal parts. Through the points A and B draw parallel lines A C and D B, forming any convenient angle with A B; upon A C and D B, set off the number of equal parts required as A-1, 1-2, 2-3, 3-4, 4-5, 5-6, 6-7, 7-8, and 8c, B-1, 1-2, etc., join A and D, 1 and 8, 2 and 7, 3 and 6, 4 and 5, etc., cutting A B in a, b, c, e, f, g, and h, which will thus be divided into nine equal parts.

Fig. 14 shows mold for side stringer intercostals inway of channel frames.

Fig. 42 shows mold for side channel stringers. The frame holes are

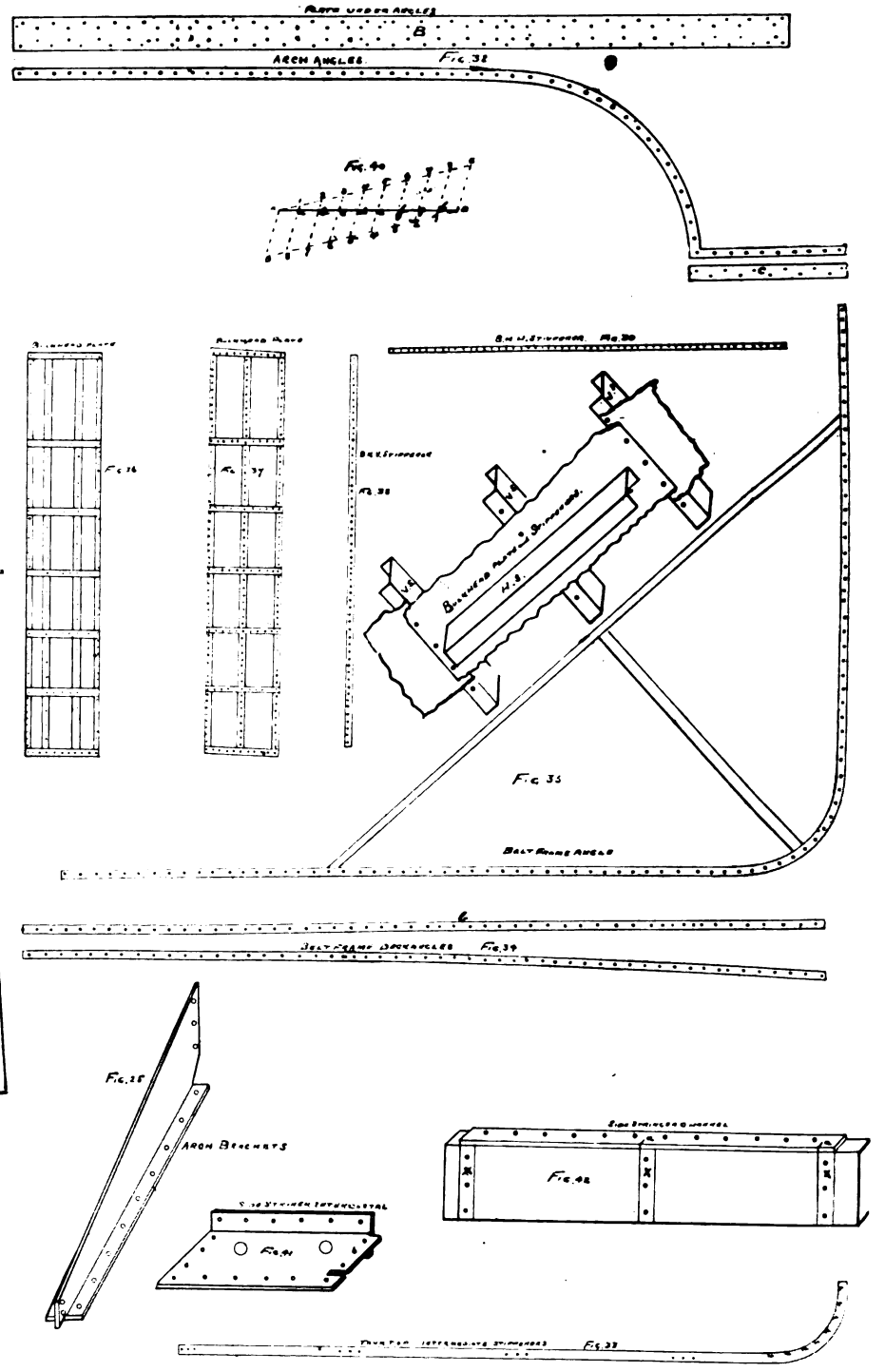


marked with short molds showing three holes at X. The flange for the intercostal connection has a continuous run of holes eight diameters. A mold two frame spaces is used with the frame space marked upon it, as shown at a, which checks any discrepancy in the commencement and continuation in the marking of the holes. There is a tendency for the material to accumulate so that there cannot be too much checking on long lengths of plates or shapes.

R. O. and A. B. McKay of Hamilton, will start the freight steamer Winona, which they have just purchased, in the upper lake trade. It left Sidney, Cape Breton, for Hamilton last Saturday.

THE GERMAN NAVY.

The German Reichstag having approved the construction of six large cruisers, in addition to the fourteen ordered to be added to the fleet in 1900, it is anticipated that Germany will have in 1917 some thirty-eight ironclads, twenty armored cruisers and thirty-eight small cruisers. Each of the new cruisers will cost $6,900,000, and the German naval budget for 1906 comprises the necessary credits for the commencement of one new cruiser, as well as for the laying down of two ironclads of the new type. The German ironclad "R" has just been launched at the Schichau yards at Dantzic. She is the fourth ironclad of the Deutschland type now afloat; the other three are the Deutschland, the Hanover, and the Pommern; the fifth is in course of construction in the Germania yard. The "R" was ordered to be proceeded with in the spring of 1905, and two years will elapse before she is ready for service. The new German ironclads, which are to have a displacement of 18,000 tons each, will each carry 28 officers and 832 men, as compared with 27 officers and 705 men allotted to ironclads of the Braunschweig and Deutschland type.



SHIP BUILDING ON THE PACIFIC COAST.

The steamer Lady of the Lake, owned by the Pacific Engineering Co., of Seattle, Wash., and now running on Lake Chelan, is to be equipped with a new engine, 10 x 22 x 14 in., which is being constructed by the Puget Sound Dry Dock Co., Tacoma, Wash.

The Matthews Ship Building Co., of Hoquiam, Wash., is building a steam schooner, with oil burning boilers, for E. T. Kruse, San Francisco. This schooner will be 175 ft. long, 38 ft. wide and 13 ft. high, with a capacity for 700,000 ft. of lumber.

The Chesley Towboat Co., of Seattle, Wash., is having the tug Argo equipped with a new boiler, 7.5 x 9 ft., at the yards of the Moran company, Seattle.

Hall Bros. Marine Railway & Ship Building Co., Winslow, are building for the Pacific Coast Steamship Co. the steam schooner Delhi. Capacity, 1,585 gross tons. Dimensions, 237.5 ft. long, 39.5 ft. beam, 17.1 ft. deep. The machinery is being built by the Moran company.

The North American Transportation & Trading Co. has had built at the yards of Hall Bros. Marine Railway & Ship Building Co., Winslow, three barges, named Idaho, Montana and Arizona, respectively, of wood, each 450 gross tons, 161 ft. long, 38.5 ft. beam and nine feet deep. These were built for towing on the Yukon river, Alaska.

Hall Bros. Marine Railway & Ship Building Co., of Winslow, are building for the North American Transportation & Trading Co. the barge Omaha, 120 ft. long, 26 ft. beam and eight feet deep.

Sudden & Christenson, of San Francisco, have under construction at the yards of E. H. Heickendorff, Prosper, Ore., the wooden steam schooner Raymond; 180 x 38 x 13 ft.; one engine, one boiler.

The Union Iron Works, San Francisco, are constructing for the American-Hawaiian Steamship Co., of New York, two steel freight steamships, the Mexican and the Columbian; each 473.2 x 57 x 42.5 ft.; two engines, 24.5, 42 and 65 by 45 in.; four boilers, 15.5 x 11.6 ft.

John W. Dickie, of Oakland, Cal., is building for the San Francisco, Oakland & San Jose R. R., Oakland, two screw ferryboats; the machinery being built by the Union Iron Works Co., of San Francisco. They are each 200 ft. long by 16 ft. beam by 18.5 ft. deep; 1,070 gross tons. One engine in each, 20 x 42 x 28 in.; each with two 1,200-H. P. Park water-tube boilers.

The Inter Island Steamship Co., of Honolulu, has under construction at the yards of the Union Iron Works Co., San Francisco, the steamship Manna Kea, steel. She will be 251.5 by 36 by 19.5 ft.; with one engine, 24, 37.5 and 62 in. by 39 in.; and two boilers, 15.6 x 11.1 ft.

The steel freight steamer Isthmian is now under construction at the yards of the Union Iron Works, at San Francisco, for the American-Hawaiian Steamship Co., of New York. Dimensions, 385 x 49.9 x 28.5 ft.; one engine, 28, 47 and 78 by 47 in.; three boilers, 14.5 x 12.8 ft.

Chas. H. Higgins & Co., San Francisco, have under construction by the United Engineering Works, San Francisco, the steam schooner California, wood (hull by Lindstrom, Aberdeen, Wash.). One engine, 14 x 32 x 24 in.; one boiler, Scotch marine, 10.6 x 10.5 ft.

The steam schooner Casco, wood, is being built at the San Francisco yards of the United Engineering Works, for Swayne & Hoyt, of San Francisco. (Hull by Kruse, Coos Bay, Ore.) One engine, 14 and 32 by 24 in.; one boiler, Scotch marine, 10.6 by 10.5 ft.

The steel water boat El Aguador, 140 x 30 x 12 feet, is being constructed for the Wilmington Transportation Co., Los Angeles, by the United Engineering Works, San Francisco. It will have a 400-H. P. compound engine.

W. A. Mitchell & Co., of San Francisco, have under construction at the yards of the United Engineering Works a steam schooner, wood; one engine, 14 x 32 x 24 in.; one boiler, 10.6 x 10.5 ft.

A MOTOR LIFE BOAT.

Messrs. J. I. Thornycroft & Co. have recently constructed at their Chiswick yard a motor life boat, built for the Newhaven station, to the order of the Royal National Life Boat Institution. The boat is 37 ft. long and nine feet three inches wide, and is fitted with a 24-H. P. Thornycroft motor. An official trial of this boat took place in the Thames on June 7, under the superintendence of Captain Nepean, chief inspector of life boats. The average speed was 7.3 knots with all equipment on board as for service, ballast being added to make up weight equivalent to that of a full crew. It will be remembered that Messrs. Thornycroft had previously constructed and engined more than one life boat propelled by steam machinery; but considerable advantages are claimed for the substitution of an internal combustion motor for a steam engine and boiler. Sir Edward Birkbeck and several members of the Royal National Life Boat Institution attended the trial.

A CURIOUS NAVY.

China has no admirals, as there is no Imperial Chinese navy. Such squadrons of small vessels as exist are commissioned by provincial viceroys. The latest list of vessels in these independent squadrons shows five protected cruisers of modern construction, the Haitchi, the Hai-tien, the Haitcheou, the Hai-young, and the Hai-tchouen; one destroyer, the Feiwang; two light armored cruisers, the Tchien-weiet and the Tchien-an; six old cruisers, the Nanchoui, the Nancheng, the Houantai, the King-tching, the Pao-nin, and the Tchien-wei; and two modern river gunboats, the An-hai and the Ting-kai. The protected cruisers and the destroyers compose the northern squadron, that of Tei-wang, stationed in the Gulf of Pechili; the others form the southern squadron, that of Nan-yang, stationed at Fuchow and Canton.

A LARGE FLEET ON THE WAY.

Any delay in the work of the rehabilitation of San Francisco, will not now be due to the lack of structural material. Already quite a large fleet of vessels are on the way to the that port with cargoes of building material. The greater proportion of the material now afloat consists of cement and structural steel. The most of these vessels came from European ports—Liverpool, Havre, Hamburg, Antwerp, etc.—but a number are coming from New York, Philadelphia, Boston, and other Atlantic ports. Already a number of vessels have reached San Francisco. These have brought cargoes of cement—the most needed commodity. In the aggregate, more than 100,000 casks of cement alone have arrived during the past 15 days.

Seventeen steamers and sixty sailing vessels are expected to reach San Francisco within the next four months. All these vessels are loaded with material that will be used in the work of rebuilding the stricken city. Structural steel and cement comprise the most of the cargoes. It is estimated that the total tonnage to reach San Francisco before the first of the coming year will reach 300,000.

The last vessel to reach the port is the British steamship Visigoth bringing 27,000 casks of Belgian cement and other structural material from Antwerp. This is the maiden trip of the Visigoth. She was built at Southhampton, England, and was launched Jan. 31, 1906. She sailed for San Francisco May 31 following.

THE MARINE REVIEW

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AUGUST 23, 1906.

OUR MERCHANT MARINE.

Probably one of the most important arguments in favor of upbuilding the merchant marine of the country by direct subsidy is afforded by the present example of the government of Great Britain in completing the two largest and fastest passenger steamers for the Cunard line. These steamers are being constructed without the expenditure of a single cent directly by the Cunard company. The British government advances to the Cunard company at 2½ per cent the sum of $13,000,000 for the construction of these steamers. In addition it pays annually to the Cunard company the sum of $750,000 as a subsidy to assist in the operation of the steamers. In other words, it makes a present of these magnificent steamers to the Cunard line and allows a sum in addition for their operation. These steamers are intended to restore British supremacy upon the sea in the matter of speed. For many years British ships held the speed record, but a few years ago this laurel passed to Germany. No British enterprise of a private character undertook to build ships to excel the Deutschland in speed. So jealous, indeed, is Great Britain of her maritime supremacy that when Mr. J. Pierpont Morgan organized his shipping combination which acquired by purchase four per cent of the British active tonnage the government became unduly alarmed over the security of the remaining 96 per cent. As tentative negotiations had been entered with the Cunard line by Mr. Morgan, the British government took the matter up with the result that the Cunard line was advanced this great loan on the understanding that it remained a British fleet. Unusual as this transaction is, who will say that it is not wise? Is it not a recurrence to that general policy established 60 years ago when Britain subsidized her merchant marine upon the advent of steam? Britain, entirely insular, was quick to see the great commercial advantage of regular lines to all quarters of the globe. Steam made regular service possible. It was reasonably assured that at the end of a given period a steamer would reach its destination. This assurance did not obtain in the case of a sailing vessel which might be delayed for weeks and even months by storms. An experimental steam service was first started to the Isle of Man; then another one to Hamburg; then a third to Gibralter; then Samuel Cunard was offered a subsidy of $425,000 per annum to establish an Atlantic mail service. This was quickly followed by the establishment of the Peninsular Co., now known as the Peninsular & Oriental. The Pacific Steam Navigation Co. was subsidized to establish the service to the west coast of South America. By 1850 Britain was paying $3,699,853 to her ocean steamers. This was rapidly added to until in 1860 she was paying $6,000,000. Continuously and without intermission, wherever the market proved attractive in any quarter of the globe, she aided private capital in establishing a line of steamers there. All of these lines were established to facilitate the delivery of the mails, but the sums granted to the steamship lines were vastly in excess of any actual service performed in the mail contract. That, of course, was but natural, since at the pound rate mail freight would have amounted to very little. The assurance of regular service, however, prompted manufacturers and merchants to develop outlying territory, to establish branch houses in foreign ports and to conduct a regular commercial business. Moreover, residents of the outlying possessions, realizing that if an order was placed for goods in England it would be promptly delivered through the regular ocean mail service naturally sent all their orders to Britain. In this manner the stupendous foreign trade of Britain was built up. Everyone knows that a trade once established and well cared for will grow. Britain's trade is growing with a natural growth and practically without any increase in subsidy. The real benefit from subsidy is its protective influence. It is needed during the period of early struggle. In the light of what Britain has done is it not natural to suppose that grants for the establishment of mail lines to various countries from Atlantic and Pacific ports will have the same results upon the American merchant marine and American foreign trade that the British grants had? The bill drafted by the Merchant Marine Commission, which made a tour throughout the country two years ago, is a perfectly sensible measure. It proposes to establish ocean lanes of trade by the projection of additional mail routes and to derive the benefit from the collection and distribution of the tonnage tax. It is certainly a bill which deserves to be given a trial.

The Pusey & Jones Co., Wilmington, Del., has the machinery built for the revenue cutter, building for the coast of Maine. Rodermond Bros., Tompkins Cove, N. Y., is building the hull.

THE MAJESTIC SAGUENAY.

A strange combination of progress and primitiveness, of all the points of interest easily accessible to the tourist, probably less is known about the Saguenay river than almost any other in the east. Never has pen adequately described the beauties of this river, which winds its way majestically between long lines of bristling fur-clad mountains for upwards of one hundred miles before losing its identity in the St. Lawrence, 150 miles below Quebec, now widening as the shore line recedes, until it forms a veritable inland sea, now contracting as the rocky guardians of that seldom broken solitude push themselves forward, forcing the dark hued flood backward until it appears scarcely a stone's throw from the deck of the steamer to the sombre piles of granite whose inaccessible face presents an unsurmountable barrier on either side.

Words fail to convey an adequate conception of the scene unfolded before the eyes of the tourist. Nor can one grasp the picture all at once. A river it is called, though it is doubtful if it has a parallel. Indeed, it is more as though at some prehistoric period, thousands of years ago, a mighty convulsion of nature had cleft the long chain of mountains asunder, leaving a giant course into which the waters found their way while seeking an outlet to the sea.

A ride up the stream is a spectacle of such imposing magnitude that time is required to grasp it, and even then the impresson is incomplete. Everything is deceptive, the air, the water, the mid-day sun or the soft beams of the silvery moon, add to the elusiveness of the surroundings and serve to still further mystify the beholder. Here distance becomes an uncertain factor, and the eye loses its cunning. So complete is the illusion that it is difficult to believe the wooden heights and barren crags, the bold promontories that rise abruptly from the water as though a master hand had left uncompleted the task of giving them form, are not in dangerous proximity to the boat instead of hundreds of yards away.

Here one is brought into close communion with the awful majesty of nature, and the mightiest works of man appear primitive and inconsequential when compared with the appalling grandeur of the environments to be found here. Even the very silence is oppressive, and the calm, unbroken solitude begets in one a spirit of reverence, an awe that is overpowering, and which increases in intensity as the journey proceeds.

The lofty cliff, the sheltered bay, the projecting rock, the seemingly never ending chain of mountains, their almost perpendicular sides rising hundreds of feet, covered with a luxuriant growth of fir and hemlock, with here and there a massive boulder forcing its head through the mass of green foliage and adding a touch of color; an occasional waterfall pushing its way through the maze, the crystal flood rushing frantically downward, tumbling, splashing, falling over the rocks in its mad haste to lose its identity in the tide below, forms a panorama that baffles the descriptive powers of the most proficient painter of word pictures.

AT HEAD OF THE LAKE.

Duluth, Aug. 20, 1906.—The figures for the week ending Aug. 14 show that the bridge accident at Duluth decreased the shipments from the Missabe ore docks by at least 100,000 tons. This was in part made up, however, by Two Harbors where they handled almost 70,000 tons more during the above period than the weekly average of those docks for the season. The confusion at the Missabe docks was much less than anticipated and the ordinary routine is now entirely resumed. The shipment figures for the seven days Aug. 7 to Aug. 14 are as follows: Two Harbors, 310,582 tons; Duluth, 244,037 tons and Superior, 218,648 tons, an aggregate of 773,267 tons. The same figures for 1905 are: Two Harbors, 288,044 tons; Duluth, 344,608 tons and Superior, 173,665 tons, totaling 806,317 tons which indicates a decrease in the week in 1906 as compared with the same period in 1905 of 33,050 tons. The season total to the 14th, 13,086,867 tons as against 12,717,007 tons last year.

During the delay all of the steam shovels in the mines shipping over the Missabe road were shut down but the underground properties were kept in operation. About 200 pockets of the new No. 4 Missabe dock will be ready for use shortly after September 1 and the entire dock will be in active service before navigation closes. It may be conservatively predicted that with all four docks working a half million tons will be easily shipped from Duluth every week.

The grain situation remains unchanged, little of interest transpiring. During the past week the heaviest shipments were in wheat, but most of the line boats are now out of the trade and moving coal and ore as rapidly as possible. The receipts and shipments for the past week compare with the preceding seven days as follows:

	Receipts		Shipments	
	Aug. 11.	Aug. 18.	Aug. 11.	Aug. 18.
Wheat	186,726	128,067	373,899	832,725
Corn	3,973	661		
Oats	164,784	49,934	335,053	125,862
Barley	157,248	74,091	210,696	289,488
Rye	15,284	9,723		25,000
Flaxseed	251,235	135,472	662,900	548,804

The coal boats were badly bunched at this port during the past week, the A. B. Wolvin for example, which arrived a week ago last Saturday loaded with coal, one of the first of the fleet delayed in the outer harbor, required just a week to get away again. The steamer F. A. Meyer, owned by Wm. Strong, of Tonawanda, N. Y., cleared from this port on Tuesday last with a cargo of lumber as large as has been shipped from here in many years.

She carried a sixty-day cargo of 1,400,000 ft. of white pine boards for Tonawanda.

A strike among the freight handlers on the docks at Duluth has been threatened. The demand is for an adjustment of conditions which it is claimed have been especially onerous for some time and an increase in wages. The Northern Pacific, which would be largely affected by such a strike, does not anticipate any serious difficulty in the matter and if a strike is ordered as seems probable now it will undoubtedly be speedily brought to an end.

FREIGHT STEAMER RALEIGH.

The freight steamer Raleigh was recently launched from the yard of the Maryland Steel Co., Sparrows Point, Md., for the Baltimore Steam Packet Co. The Raleigh is 233 ft. eight inches over all, 222 ft. between perpendiculars, 33 ft. beam and 23 ft. deep. She is equipped with a triple-expansion engine, 19, 30 and 50-in. cylinder diameters by 30-in. stroke, supplied with steam from two Scotch boilers, 11 ft. 7½ in. diameter by 12 ft. long, allowed 170 lbs. pressure. She is built to the United States standard rules, A1, 20 years. She has two masts, leg of mutton sails, and her equipment is modern throughout. Accommodations are provided for a crew of sixteen with three spare rooms.

A boat not often seen at Duluth made this port last week and cleared Wednesday with flax for Kingston, Ontario. She was the Turret Chief of the Turret line plying principally between Canadian ports and one of two or three boats on the lakes of the whaleback type such as were built at Newcastle-on-Tyne where the Turret Chief came from some years ago.

REMOVING THE FIXED SPAN.

Navigation between the upper and lower harbors at Duluth was reopened after 89 hours of delay caused by the wreck of the interstate bridge, when Whitney Bros., the contractors, removed the fixed span of the bridge from its piers on the Wisconsin side to a temporary pile support near the Northern Pacific railway bridge.

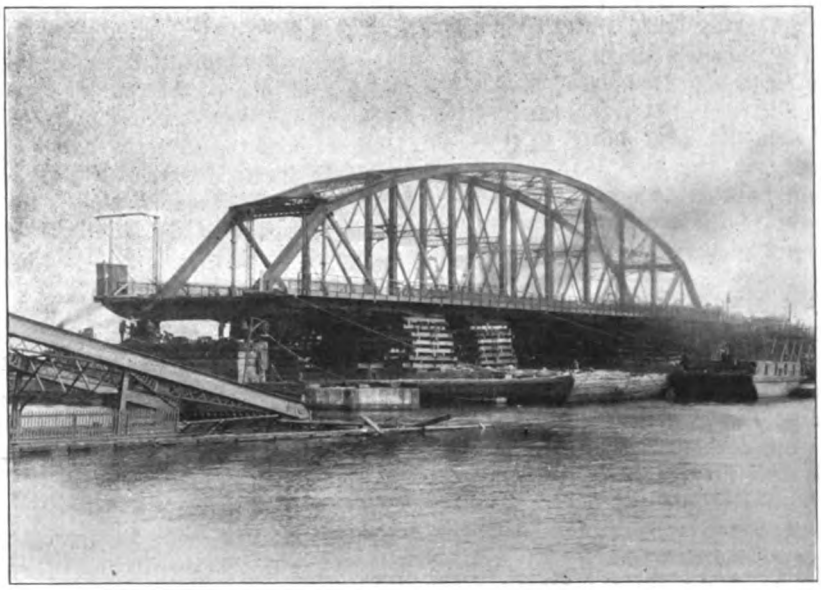


FIG. 1. SHOWING ARRANGEMENT OF SCOWS UNDER BRIDGE, TIMBERED UP TO BRIDGE, AND THE SPAN ABOUT A FOOT CLEAR OF STONE ABUTMENTS.

The big 800-ft. steel span was moved without an accident and the successful termination of the plans of the contractors was greeted with a joyful tooting of whistles from the boats tied up on either side of the bridge with owners either anxious to get out with loads or to get in for loads.

The bridge rested on four of the Duluth Dredge & Dock Co.'s large scows, the boats having been sunk previously, and a timber support built up to the bridge stringers. When all was in readiness, the water was pumped out of the scows and, as they rose, the big 230-ft. steel span was slowly lifted from its stone piers. The tugs Medina, Walton B. and Emmett towed it over to the place where it will rest pending the repair of the draw. The scows, it is claimed, had an aggregate carrying capacity of four times the weight of the bridge.

While the feat accomplished by Whitney Bros. is by no means a remarkable one as compared with the removal of other large bridge structures in the country, yet the contractors are being highly complimented because of their ability as an "emergency" firm. To assemble men and material, and to finally move an 800-ton structure over water, practically between Sunday and Tuesday evenings, is considered a pretty good record and one that has been of much interest to engineers and vesselmen.

With the fixed span out, there is a 170-ft. channel with from 25 to 30 ft. of water and a 230-ft. channel with at least 19 ft. of water.

The steamer Wells was the first boat through after the span was taken out. She was followed by the Peck, the Tionesta and some twenty or thirty other boats. The new channel will be used during the time that the drawbridge is being rebuilt, when the fixed span will be replaced and the boats will resume their passage of the two old channels. The only difference that the vessel trade will notice is the fact that only one boat can make the bridge passage at a time where they could pass each other through the draw, on going either side of the center pier.

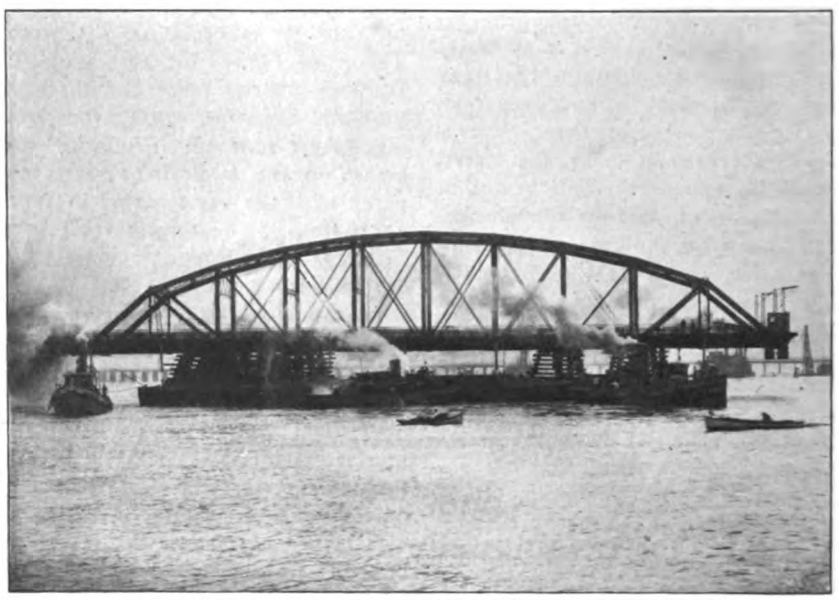


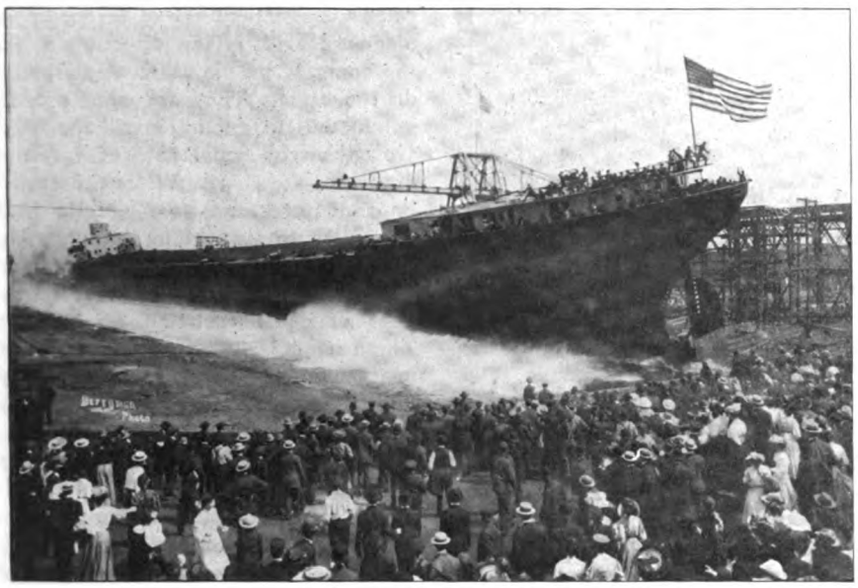
FIG. 2. SHOWING THE SPAN CLEAR OF ABUTMENTS AND THE PILE DRIVER TO EXTREME RIGHT, DRIVING PILES NEAR THE NORTHERN PACIFIC RAILROAD BRIDGE, WHERE SPAN WILL REST UNTIL DRAW IS FIXED.

LAUNCHING THE TOWNSEND AND REAM.

The largest freighter by two feet now afloat on the great lakes was successfully launched at noon Saturday when the A. Y. Townsend slid into the water at the Superior Ship Building Co.'s yards. The new boat has been building since March 1 and will be ready to sail in about ten days in charge of Capt. Edward Sullivan and chief engineer Frank Warner as the latest of the Hanna fleet. The boat was built for the Cambria Steel Co. and named after one of the early members of that company. Miss Emily Phelps, of Marquette, and the granddaughter of President W. F. Fitch, of the Duluth, South Shore & Atlantic road acted as sponsor and laden with an immense bunch of American Beauty roses, the gift of the ship building company, she most auspiciously inaugurated the first advance beyond 600 ft. for the length of inland lake steamers. The other members of the launching party were: Pres. W. F. Fitch, Mr. and Mrs. A. M. Marshall, Mr. and Mrs. Ward Ames, Mr. and Mrs. F. A. Patrick, Mr. and Mrs. Phelps, Mr. and Mrs. Buck and Miss Buck, Miss Jessica Marshall,

Capt. and Mrs. A. B. Wolvin and Mr. Fred Wolvin.

Some of the specifications of the new boat are: Length over all, 602 ft.; keel, 580 ft.; beam, 58 ft.; depth, 32 ft. Her engines are triple-expansion with cylinders 24, 39 and 65 in. in diameter by 42-in. stroke supplied with steam by two Scotch boilers 15 ft. 4½ in. mean draft and 11 ft. six inches long fitted with Ellis & Eaves induced draft and to have a working pressure of 170 lbs. The pumps will



LAUNCHING OF THE STEAMER A. Y. TOWNSEND AT SUPERIOR.

consist of a 14-in. DeLaval turbine pump with a capacity of 6,500 gallons per minute and two Duplex pumps, one 14 x 18 x 18 and one 12 x 16 x 18. There are several unique features in the construction and fitting out of this boat, among them a new system of ballast manifolds to be used for the first time. The object of the new arrangement is similar to that on the recent 600-footers whereby the water can be lifted on one side and discharged on the other, but the piping system is entirely an innovation.

The steamer Norman B. Ream, the third of the quartette building for the Pittsburg Steamship Co. was successfully launched from the South Chicago yard of the American Ship Building Co. last Saturday. The new boat was named by Mrs. Redmond D. Stephens, daughter of Mr. Ream. These four steamers are 600 ft. over all, 580 ft. keel, 58 ft. beam and 32 ft. deep. They are equipped with triple-expansion engines, with cylinder diameters 24, 39 and 65 in. by 42-in. stroke, supplied with steam from two Scotch boilers 15 ft. four inches by 11 ft. six inches. The fourth steamer, P. A. B. Widener, will be launched some time next month. Among those who witnessed the launching were: President H. Coulby, of the Pittsburg Steamship Co.; D. Sullivan, of Chicago; J. H. McLean, of Duluth; O. C. Davidson, of Iron Mountain and Robt. Logan, of Cleveland.

FREIGHT SITUATION.

The freight situation on the lakes continues in practically the same condition as last week. Vessel dispatch is not quite as good as it was owing to shortage of cars at lower lake ports. As September approaches the railways have to divert considerable rolling stock to other trades owing to the general accumulation of business and dispatch for that reason is never as good during fall months as during spring and summer months. There is little disposition manifested on the part of vessel owners to advance the freight rate on ore, probably because the great majority of their tonnage is under contract; nevertheless, one shipper, who was badly in need of tonnage practically offered five cents additional on a block of ore, promising to credit that amount later. But with the exception of one slow Buffalo dock no direct advance has been made in the ore trade. There is considerable ore afloat on the Lake Erie ports.

Forty cents has been offered on coal at the head of the lakes from Lake Erie ports making the rate 40 cents to Lake Superior and 50 cents to Lake Michigan, both for hard and soft coal. Even at this rate coal boats are not plentiful; however, there is a perceptible lessening in the amount of coal arriving at Lake Erie ports.

The Chicago grain rate is two cents which is equivalent to 80 cents on ore. Very little spot tonnage is being taken from the head of the lakes and the vesselmen are in no hurry to charter. Cargoes of wheat are offered at 3½ cents for the first half of October.

SWIFT AND POWERFUL CRUISERS.

The statement published to the effect that in place of two Dreadnoughts and two big armored cruisers—the original ship building program for this year—the government, as a result of a compromise with the board of admiralty, intend to build three Dreadnoughts, is authoritatively confirmed. These ships will be laid down at an early date, one being constructed at Portsmouth, another at Devonport, and a third by a private ship building firm. By the end of the year after next the British fleet will thus obtain, with the vessel now completing at Portsmouth, a homogeneous strategical unit of four of these powerful men-of-war, mounting 40 guns of the new 12-in. type, throwing an 850-pound shell, and 108 12-pounder anti-torpedo-boat weapons, with a very rapid fire.

The squadron of Dreadnoughts will have a sea speed of 21 knots, and will be able to cross the Atlantic and return without recoaling, so ample will be the provision of coal and oil fuel. These ships will draw less water than any battleship built in recent years, and will be admirably suited either for service in the shallow waters of the North sea or for use east of Suez, as they are all well proportioned for passing through the canal. In spite of their great displacement, 17,900 tons, the Dreadnoughts will require 18 inches less water for navigation than the 15,000-ton battleships of the Queen, Bulwark, and Formidable types, and will have the advantage of three knots in speed, while they will mark a gain of 42 inches in draught over the Majestic class, of which one, the Victorious, it will be remembered, stuck for some time off Port Said when on her way to China. These four Dreadnoughts, on the other hand, will be the longest and broadest battleships hitherto built, and will form the swiftest and most powerful battle squadron in the world's fleets.

William E. Woodall & Co., Baltimore, are building two covered lighters, 125 ft. by 28 ft. by eight feet for the Southern Railway Co. for use in Norfolk harbor.

Horace Lee, 1 Broadway, New York, is preparing plans for the construction of two steamers for the New York & Porto Rico Steamship Co.

SCIENTIFIC LAKE NAVIGATION

By Clarence E. Long

PART II.

ATTRACTIVE POWER OF THE MAGNET.

If the end of any magnet be dipped into a little heap of small iron filings it will be found that a large portion of the filings will cling to the magnet, forming a loose bunch around the end. It will be seen, too, that it makes no difference which end of the magnet be taken for the experiment. It will also be seen that no filings can be made to adhere to the middle portion of the magnet, unless the magnet be very thick in proportion to its length, the filings may adhere to all parts of it, but the quantity will be found to diminish rapidly towards its middle. This experiment illustrates a principal property of the magnet, and the facts brought out by it should be carefully remembered.

Experiment.—Take a bar magnet and lay it upon a sheet of paper placed on a table. Sprinkle iron filings over the whole length of the magnet. Now take hold of the middle part of the magnet and lift it out of the iron filings. It will be found that the filings cling to the magnet the same as before.—See Fig. 2.

LINES OF MAGNETIC FORCE.

Experiment.—Lay a bar magnet upon a table and put over it a sheet of smooth paper. To keep the surface of the paper level lay on the table about three inches on each side of the magnet two strips of wood the thickness of the magnet. Be sure to make the surface of the paper perfectly level. Now sprinkle all over the paper iron filings (soft iron filings) perfectly free from dust. (The filings may be sifted through fine muslin. Cardboard or glass may be used instead of paper). Notice in Fig. 9 the way in which the filings arrange themselves. Perhaps it may be necessary in order to get them to start moving—that is, to overcome the resistance of friction which prevents their moving—to gently tap the paper, glass or cardboard with a pencil. If the experiment be carefully made it will be found that the filings have arranged themselves something as in Fig. 10. The power exhibited by a magnet at its poles is called magnetic force.

Here is another experiment similar to the one just given, showing lines of magnetic force. If one of the poles, say the south pole of a strong magnet be placed against the underside of a horizontal plate of glass, on the upper side of which iron filings will become magnetized by induction through the glass, and if the glass be lightly tapped, the filings tend to arrange themselves in lines radiating from the portion of the glass immediately over the pole of the magnet, as in Fig. 10.

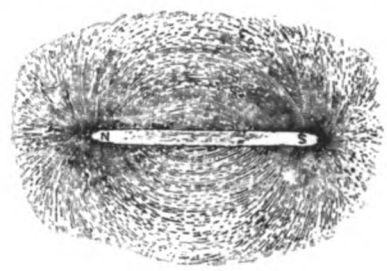


FIG. 9.
Showing the "lines of force" which a bar magnet exerts.

This is caused by the attraction of the magnet beneath the glass, for the opposite pole of each iron filing, which has been rendered a temporary magnet by induction; hence when the filings are jarred by the tapping on the glass, each points its greatest length, or axis, away from the locality of the bar magnet, thus producing the radiating lines. These are called lines of magnetic force, because if a permanent magnet, freely swinging on a pivot at its center, be set upon the glass it will come to rest with its axis parallel with the line or ray beneath it, and its north pole pointed toward the south pole of the magnet beneath the glass. The opposite conditions would take place were the magnet held under the glass changed end for end. Note.—No matter how small a piece of iron or steel may be when it becomes magnetic it possesses the two poles and equator of any and all magnets. It does not seem reasonable at first thought, that an iron filing could possess these qualities, but it is nevertheless a fact.

Fig. 10 admirably illustrates the manner in which the compass needle is forced to point in the direction of the earth's north magnetic pole. The earth's magnetic lines of force, or its magnetic field, is the direction which the compass needle takes at all places on the earth. They are what are denominated magnetic meridians, and are shown by equal lines of variation drawn on the chart. While the earth's lines of force, or its magnetic field, is similar to that of an ordinary bar magnet, the lines are very erratic as shown by the devious courses of the lines of equal variation on a chart. These irregularities in the distribution of its magnetism, are, in all probability, due to the very uneven surface of the earth as well as its oblate form.

Fig. 10 also shows the lines of magnetic force, but with only the one pole of a magnet in action; hence the lines shown radiate instead of forming ovals as in Fig. 9, where both poles of the magnet are acting.

MAGNETIC FIELD.

We have now come to an important definition: The space about a magnet through which it exerts its magnetic force is called its "magnetic field." In our illustration Fig. 9 appears as if the magnetic field were a plane, but in reality, as may easily be inferred, the magnetic field encompasses the magnet on every side. It is therefore a "space" instead of a "plane." The magnetic field indeed for every magnet entirely encompasses it and extends in every direction; but, of course, for small magnets, the field of appreciable influence is also small; and even for the largest magnets its limits are soon reached.

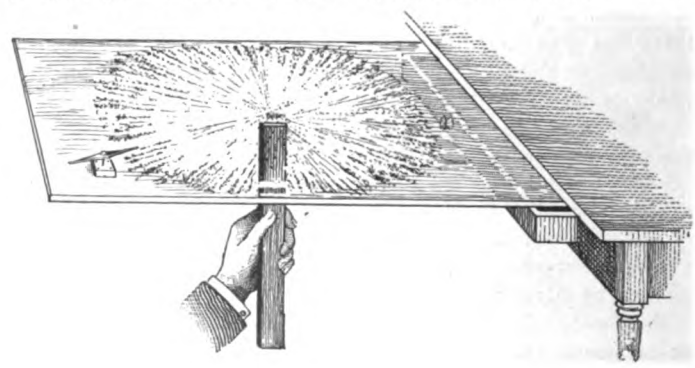


FIG. 10.

THE MAGNETIC NEEDLE.

When a piece of steel is magnetized and delicately balanced upon a pivot so as to be free to turn in any direction it is called a "magnetic needle." The piece of steel of which it is made has a hole in the middle in which is fitted a cap of steel or agate. The pivot upon which the cap is placed is also of steel. The upper part of the figure shows the under side of the needle.

MUTUAL ACTION OF THE POLES.

The two poles of a magnet appear identical when they are brought in contact with soft iron filings, but this identity is only apparent, for on presenting one end of a magnet to one end of a magnetic needle, suspended at its center of gravity, or poised on its center, we obtain either attraction or repulsion, according as the pole presented is similar or dissimilar to that which is presented. See Figs. 4 and 5.

One would naturally suppose (after having learned the first law of magnetism that the *like poles of any two magnets repel each other* when brought near together, and that the *unlike poles of any two magnets attract each other* under the same conditions) that when one end of a magnet was dipped into iron filings, or brought in contact with a piece of soft iron, and attraction takes place as it does, that when the other end of the same magnet is dipped into the same filings, or brought in contact with the same piece of soft iron, that repulsion ought to take place. This is due to what is called magnetic induction and magnetic induction is the magnetism induced or developed into *soft iron* by the magnetic influence of the magnet it was held near to or against, that is, the magnet when brought in contact with a piece of soft iron, or even when it is simply brought near to it, imparts magnetism to the piece of soft iron, which for the time being, becomes itself a magnet with two poles and a neutral portion between them. In magnetic induction attraction always takes place, because, which ever pole of the inducing magnet is presented an opposite effect occurs, as we have already seen.

Remember that it is only soft iron that becomes readily magnetized by a magnet, and that it loses its magnetism as readily as it gained it when the influencing force is removed, or taken away altogether.

Soft iron is iron which becomes instantaneously magnetized by induction when exposed to any magnetic force, but which has no power of retaining magnetism, and it has, therefore, no independent magnetism; all its magnetism is transient induced magnetism. If hard iron were used instead of soft iron it would be found to take a longer time for the iron to acquire this magnetism and also a longer time for it to part with it, and in some cases it might retain enough of it to remain magnetic. If so and the hard iron bar was in point of size about as large as the magnet used for the experiment, attraction and repulsion will take place. So be sure and remember the difference between soft and hard iron.

As we have seen, when a piece of soft iron is held in contact with or near to a permanent magnet it becomes for the moment magnetized and attracts iron filings, etc., just as the permanent magnet does. But the soft iron cannot be permanently magnetized, as it loses its magnetism as soon as it is removed from the field of influence of the bar magnet it was placed against. Also, the harder the steel bar is the more difficult will it be to become magnetized by the rubbing process to be described, but the longer will it retain its magnetic power when once magnetized.

MAGNETIC FORCE.

The power which a loadstone, or magnet exerts in drawing or attracting iron filings, iron weights and other matter is called its "force," its "magnetic force."

Experiment.—Take a bar magnet and mount it horizontally so that you can experiment with it easily as required. Then take a piece of soft iron wire and cut it up into lengths of about one-eighth of an inch, each to be used as weights. Place the weights as in Fig. 8, at *a*, *b*, *c*, *d*, etc. It will be seen that at *a* more weights will be held suspended by the magnet than at *b;* and at *b* more than at *c;* and at *c* more than at *d*.. Similar phenomena will be obtained in experimenting with the other end. It will be found that no weights can be suspended from the middle of the bar. See Fig. 11.

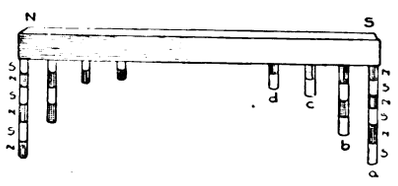


FIG. 11.

A bar magnet with small soft iron weights suspended, showing at what parts of the magnet the force of magnetism is greatest, and where least.

Note.—"Magnetic iron ore" (the loadstone) is found in various parts of the world. When found in a shape convenient to handle, and in sufficient purity to show its magnetic power readily, it is called "loadstone," which means a "leading, or drawing stone." All ores of iron are more or less magnetic, especially when in large quantities. Loadstones are now found principally in Siberia and Scandinavia.

HOW A BAR MAGNET MAY BE MADE BY RUBBING, TECHNICALLY KNOWN AS METHOD OF SINGLE TOUCH.

Experiment.—Take a bar of smooth polished steel, such as any blacksmith can make for you—polish before tempering—of the same shape as your bar magnet, only thinner and smaller.

The steel bar to be magnetized is placed horizontally on a table, and one of the poles of the magnetizing bar, held vertically, is brought into contact with it at one of its extremities. The magnetizing bar is then to be drawn, or rubbed, parallel to itself, along the surface of the steel bar to the other end, taking care to raise the bar magnet from the bar at the other end of each rub and to carry it back in the air to the first end again for the next rub. After ten or twelve such rubbings the steel bar is to be turned over on its other face and the process repeated, taking care that the same pole of the acting magnet is employed, and that it is always moved in the same direction. It will now be found that the smaller bar is magnetized and that its magnetism is permanent. The end, or pole, of the steel bar at which the pole of the magnet leaves the bar will always be of the *opposite* magnetism to that of the magnetizing magnet; that is, if the north-seeking (or red) end of the magnet is used the end of the steel bar last touched by it will be a blue or south-seeking pole. Or, it may be stated thus: If the rubbing has been done with the N-pole of the magnet the N-pole of the new magnet is the end of it which was first touched in the rubbing process, and the S-pole the end of it which was last touched, and vice versa if the rubbing was done with the S-pole of the magnet. See Fig. 12 for the way in which the rubbing is to be done and for the positions of the poles.

This process will answer sufficiently well when the needle, or bar magnet, to be magnetized is of small dimensions. It cannot impart to large bars all the magnetism of which they are capable, it has the inconvenience of generating consecutive or subsequent poles, when the bar to be magnetized is long, unless much care be taken in giving an equable motion to the moving magnet.

Consequent Poles.—Every magnet as we have seen has two poles and a

neutral line; sometimes, however, in magnetizing bars and needles, poles are produced lying between the extreme points. These intermediate points are called *consequent poles.* The same care must be exercised in magnetizing by electricity; the magnet must be pulled forward and back through the electrical current (coil) and the current turned off before the magnet is removed from the magnetic coil.

Note.—In magnetization by rubbing remember not to rub back and forth, but only the one way.

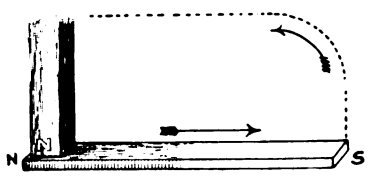


FIG. 12.

Showing how an artificial magnet may be made out of a thin bar of steel. Note how the rubbing magnet is to be carried back after each rub; also the positions of the poles of the new magnet.

CONVERTING NEEDLES AND KNITTING NEEDLES INTO MAGNETS.

Experiment.—Small needles may be converted into permanent magnets by a single rub from end to end with one pole of a bar magnet. In this manner magnetize three or four needles and then place them aside for future use. Magnetize them all in the same way, so that the eye of each needle will be a N-pole and the point a S-pole. This you will find a matter of convenience when afterward you may be experimenting with them.

Experiment.—Take two steel knitting needles and mark an end of each by a piece of colored silk thread tied tightly about it. Then magnetize the needles by laying them parallel-wise on a table and drawing a bar magnet carefully from the middle of the needles to the marked ends. If you wish the marked ends of the needles to be N-poles use (as you already know) the S-pole of your magnet for your rubbing end. Be sure to carry the magnet after each rub back again through the air as indicated in the diagram. When the rubbing has been done in this way several times magnetize the other ends of the needles in a similar manner, only being careful to use the other end of your bar magnet in doing so. You have now two highly magnetized needles which will be very useful to you in numerous experiments. In experimenting with the needles be sure to keep your bar magnets well out of the way, or else their magnetic influence may interfere with the action of the needles.

MAGNETIZATION BY METHODS OF SEPARATE AND DIVIDED TOUCH.

This method consists in placing the two opposite poles of the magnets of equal force in the middle of the bar to be magnetized, and in moving each of the magnets simultaneously towards the opposite ends of the bar. Each magnet is then placed in its original position and the operation repeated. After several frictions on both faces the bar is magnetized.

The smaller the inclination of the rubbing magnets the more advantageous, and the process is still more effective if the ends of the bar are meantime supported on the opposite poles of two other equally powerful magnets, the poles being the same name as those of the two magnets used for stroking the steel bar. The relative position of the poles of the magnet is indicated in Fig. 13. This method produces the most regular magnets. The maximum effect is produced when the inclination of the rubbing magnets is reduced to two or three degrees.

It will be seen that the making of artificial magnets is an important art. It also constitutes an important step in the study of magnetism. Artificial magnets are permanent, though they will at first lose a certain amount of their superfluous magnetism, but after settling down to "saturation point" will remain in a permanent state indefinitely, provided they are made of a

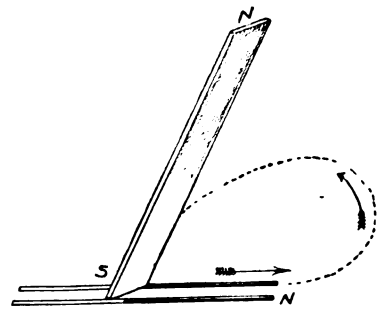


FIG. 13.

Showing how to magnetize a pair of knitting needles.

good quality of steel and properly tempered. It is also seen by the rubbing process that the piece of steel or knitting needle, thus made a magnet, possesses all the property of the magnet used for the magnetization. It will attract iron filings at either end and when presented to a suspended needle either attraction or repulsion takes place. It must likewise be known and observed that the magnet used for the rubbing process has lost none of its magnetic power in the operation. This (the power of making other magnets without loss to itself) is a property of magnets that should be remembered by the student.

It is often necessary in making experiments in magnetism to be able to suspend a loadstone, a magnet, a magnetic needle, etc., in air, so that it will turn very freely when under the influence of some magnetic force. The following methods may be used:

1. Make a stirrup of copper wire and hang it to a support by means of a piece of untwisted silk or by a horsehair. Copper wire is used because copper is so slightly perceptible to magnetic influence as to be practically non-magnetic. This sort of stirrup is used when it is necessary to experiment with loadstones or bar magnets that are somewhat heavy. The "untwisted" silk thread is necessary because the "torsional" or "twisted" effect of a thread, if it had any twist of its own, would mar the delicacy of the results you might obtain in the experiments you made with it. See Fig. 14.

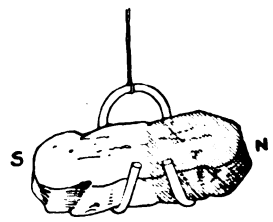


FIG. 14.

Showing a loadstone suspended in a copper-wire stirrup. Color that half marked N with red and the other half marked S with blue.

2. Obtain a piece of cork that will just hold up (and no more) in water the bar magnet or magnetized needle or piece of magnetized wire that you wish to experiment with. Make the cork round in shape and smooth, so that it will easily turn in the water when any magnetic force is brought to bear upon the bar needle or wire that it supports. See Fig. 15.

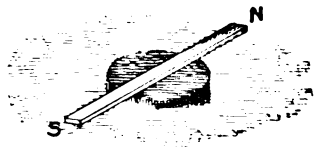


FIG. 15.

Showing a round and smooth piece of cork used to support a bar magnet. Color the N or shaded half red; the S or light half blue.

3. A paper stirrup with untwisted silk thread may be used as in Fig. 3.

4. For delicate experiments it will be best to contrive a movable support like that shown in Fig. 16. The stirrup in this case is of paper.

THE NORTH-AND-SOUTH SEEKING PROPERTY OF MAGNETS.

Experiment.—Suspend so as to move freely in air without interference from any magnet or loadstone near

by a loadstone or bar magnet as in Figs. 14 and 15, a magnetized knitting needle as in Fig. 3, a magnetized needle as in Fig. 16. In every case it will be found that the magnetized object (whether loadstone, bar, knitting needle or needle) will settle itself in one direction—namely, with one pole

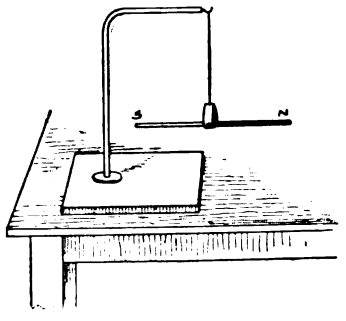


FIG. 16.

Showing a movable support. The stirrup is of paper. Color red and blue.

turned toward the north and with the other pole turned toward the south. It will be found, too, that no matter how much the magnets be disturbed from this position of rest they will invariably return to it again when the disturbing cause is removed. Care should be taken always that the suspending thread is untwisted silk.

This tendency of magnets (both natural and artificial) when left free to move, always to fix themselves in a position pointing north and south, is the second great distinguishing property of magnets (the power of attracting iron being the first).

THE DIFFERENCE BETWEEN THE POLES OF MAGNETS.

By experimenting with the magnets, etc., as above suspended it will be found, too, that no matter how they are disturbed one definite end of each of them constantly points to the north, or seeks to point to the north, while the other end just as constantly points to the south, or seeks to point to the south.

This is the reason why one end or pole of every magnet is called the "north end," or "north pole," or "north-seeking pole," or simply the "N-pole," and why the other end is called the "south end," or "south pole," or "south-seeking pole," or simply the "S-pole."

Note.—No matter in which position the magnetic needle is displaced it will eventually come to rest in a north and south line. If the north end of a suspended magnet be reversed (end for end) and delicately held between the forefinger and thumb in a south direction for a few moments and then released it will oscillate rapidly at first and then gradually diminish in vibrational movement until it comes to rest in a north and south direction, with its north end towards the north and its south end towards south.

MORE ABOUT "OPPOSITE" AND "REVERSE."

Figuratively speaking, or in our every-day language, the terms "opposite" and "reverse" are employed indifferently to convey the same meaning, but when these terms are used in conjunction with courses and bearings as shown on the compass, each admits of an additional qualifying term not previously recognized. For this reason it has been found both convenient and necessary to adopt a specified meaning for each term in order to readily distinguish between them. Therefore:

Reverse bearing or course, is the bearing or course, taken from the second end of the course looking backwards. If a direct bearing is N 23° E, the reverse bearing will be S 23° W, hence, N is changed to S, and E to W, or vice versa. If you steered N by E ¼ E from Chicago to Pt. Betsey and steered back S by W ¼ W, and made Chicago, you would be making a "reverse" course of it, since S by W ¼ W is the reverse of N by E ¼ E. This would not be an "opposite" course, as so many call it. All courses printed on a chart are reverse courses, since if you reverse the course that is printed alongside the course you will get its direction the other way.

Reverse course or bearing is used in many ways. In the old method of getting the deviation of the compass by "recriprocal simultaneous bearings," that is, the observer on board takes a bearing of the observer on shore, and simultaneously, the observer on shore takes a bearing of the observer on board. Then to get the correct magnetic direction, or point, that the observer on board is from the observer on shore the bearing taken by the shore observer is "reversed."

To box the compass by "reverse points," thus, North, south; N by E, S by W; NNE, SSW, etc.

Reverse on the compass always cuts the card into equal parts, the same as a diameter of a circle cuts the circle into equal portions. Reverse points are points situated on the same line diametrically from each other. Reverse course or bearing is always 16 points or 180 degrees difference.

Opposite means across the compass, as from NE to NW, or vice versa, or NE and NW are opposite each other, or they are opposite points from each other.

A line connecting opposite points will cut the card into unequal parts. In this respect it is very much on the same principle as a parallel of latitude. A parallel of latitude cuts the earth into unequal portions.

Opposite course of bearing means the same number of degrees or points from on one side of north or south to the same number of degrees or points on the other side of north or south. Thus, the opposite of N 60° E still remains N 60°, only toward west instead of east; therefore, the starting point and the angle remain the same except east is changed to west, or vice versa. East is always changed to west or west is changed to east.

The reverse of N 60° E would be S 60° W. Here the direction is reversed; N is changed to S, and E is changed to W. The angle remains the same but it is reckoned from reverse points; and is, therefore, always 180 degrees difference.

North and south are both opposite and reverse of each other, and the same thing is true of east and west, but these are the only cases.

The sun (or any other celestial body) is said to rise and set at opposite points of the horizon in the same latitude for the same rotation of the earth. Supposing the bearing of the sun at rising is E by N, its bearing at setting will be W by N and not W by S, as one would readily imagine if the term "reverse" were used in place of "opposite," as is so often the case.

The Azimuth Tables afford a good illustration of "opposite" bearing in that the same bearing, or azimuth, corresponds to two different but "opposite" times, one of which is in the a. m. and the other in the p. m. The time a. m. is exactly the counterpart of the time p. m., that is, the time p. m. corresponds to the same time a. m., or the time p. m. is the same distance in arc from 12 o'clock, or the meridian, as the distance of the arc from the time a. m. to 12 o'clock. In other words, the hour angle for the p. m. time equals the hour angle for the a. m. time, one being west of the meridian, the other east of the meridian by the same amount.

For example: At 4 p. m. the sun will have the same bearing west of the meridian that it had east of the meridian at 8 a. m., therefore, the sun occupies a similar but opposite position in the sky at those times. It is then the same number of degrees or points west of the meridian that it was east of the meridian. Another thing, the hours 4 and 8 are opposite each other on the face of the clock, and they are at equal arcs on either side of the numeral XII, which represents the meridian.

Now, to understand why all this is:

In the rotation of the earth, as well as its annual revolution, its axis preserves, at all times, the same direction, as if the orbital movement had no existence; and is carried round parallel to itself, and pointing always to the same vanishing point in the sphere of the fixed stars. Hence, the sun being fixed and the earth turning on its axis, must cause the sun to describe one and the same path all the way round; that is to say, the sun's bearing will be the same number of degrees from the meridian for equal hour angles during the same rotation.

It is the earth's forward movement in its orbit, or its movement round the sun, that changes the bearing of the sun from day to day in the same latitude, or what is the same thing, a change in declination.

The term "opposite" likewise affords an explanation of the declination of the sun. With north declination and in north latitude, the sun will rise and set to the northward of east and west. If in north latitude with south declination the sun will rise and set to the southward of east and west.

Some books in explaining amplitude work, say, reverse the bearing at rising to determine the bearing at setting, as in the case of the sun, where only the a. m. bearings are given. This is absurd. It should read, take the "opposite" of the bearing given, to get the p. m. bearing. Take in the latitude of the lakes in the middle of the summer, the sun at rising bears something like NE by E. Anyone, who would give it but a moment's thought, would see at once that it would not set bearing SW by W, the reverse of NE by E. Opposite is meant, therefore, it would set at NW by W. No wonder the study of navigation is a bugbear to some men, and such confusing rules and definitions are, in many cases, to blame for it.

What point of the compass is opposite E ½ N? Ans. W. ½ N.

What is the reverse point of NE ½ E? Ans. SW ½ W.

If the bearing of the sun at rising, on a certain date and place, was ENE ½ E, what would its bearing be at setting? Ans. WNW ½ W.

LONG.

A QUERY ANSWERED.

Editor MARINE REVIEW:—I would like to ask, "What are the magnetic poles composed of? Some say that it is magnetic ores and others say that it is electricity caused by the earth's rotation."—J. G. H.

The shortest answer and an absolutely truthful one is, "No one knows." The cause of terrestrial magnetism is undetermined, but it is not improbable that it is induced by electricity generated in the luminiferous ether by the rotation of the earth. The magnetic poles are as indefinite as the end of the rainbow. There is absolutely nothing to show what the magnetic poles are composed of any more than we can see why the compass needle aligns itself in the magnetic meridian. We know that it does, and can see that it does, but we cannot see the cause. If either of the magnetic poles was located in the middle of Lake Michigan say, instead of where they are, there would be no change in the appearance of the water embracing the area on this account; things would look just the same as they do now and nothing would be seen to indicate its position, since magnetism is an invisible fluid without sensible weight. The only way of telling the location of the magnetic poles is by the action of the compass needle, and also by the action of the dipping needle. At the magnetic poles all compass action ceases, since there there is no horizontal force (only vertical force) to give it direction; but the dipping needle is at its best since it points vertically downwards. This was the manner in which the north magnetic pole was discovered. Sir James Ross, in his voyage of arctic discovery sailed over a certain area where the compass refused to work on account of the intense magnetic force below the needle which drew the north end of the compass card down till the sides of the cone-shaped cap fouled the pivot bearing rising from the center of bowl. Before Ross arrived within the area or region called the magnetic pole, the compass on board had varied to a considerable extent, and between this area and the true north pole the needle swung absolutely half around and pointed south instead of north. (variation 180°). This is because the compass needle points to the magnetic and not to the true pole, so that to go north from the north magnetic pole one would have to steer south by the compass. The direction though, is north in reality. The area where the dipping needle pointed vertically downwards was denominated the north magnetic pole. It must be understood that it was not only in one spot where the dipping needle pointed thus, and that this spot was directly over the magnetic pole. On the contrary the dipping needle assumed this vertical position within the whole area denominated the magnetic pole. Hence the magnetic poles are not represented by a mere point as are the true poles, but include a considerable area, amounting probably to more than 50 square miles. The compass needle does not necessarily point to the center of this area, but may point to any portion of it and still be under its control. That is to say, compass needles located at different points on the earth do not point precisely to the self same spot in the area called the magnetic pole. If the magnetic pole was a mere spot like the imaginary true pole, then all magnetic needles would point to the same spot. This has little or no significance in navigation, since it does not matter a jot the direction the compass needle takes at any place so long as the same influence that controls it will cause it to point always in the same direction, and that it can be relied upon from year to year after applying the proper allowance for its annual movement caused by the poles shifting their position. The shifting of the magnetic poles is another phenomenon that cannot be satisfactorily explained. We simply know all these things by observation while the cause goes unsolved.

When bar magnets are suspended side by side, so that they are free to move in a horizontal plane, but are far enough removed so as not to have influence upon one another, they arrange themselves parallel to one another. The direction they take is called the magnetic meridian. Hence, because a compass needle (which is simply a bar magnet) always arranges itself in a north and south line, this result is the same as if the earth were an immense magnet, with one pole at the north, and the other at the south. Hence, the theory is, that the earth is really a magnet, and the magnetic force of the earth compels the compass needle to take this position. But the apparent ends of the earth's magnetism do not coincide with the true north and south poles of the earth. We know that the compass needle does not point true north only in a few places, and this is because the places lie in such positions on the earth that the magnetic and true poles of that region are in range with each other. The north magnetic pole to which the compass needle points, is located at a point among the islands in the Arctic ocean, north of North America, and that this north magnetic pole is not stationary, but has a slow motion. About the south magnetic pole we know next to nothing, because it is located in the waters of the Antarctic ocean, and cannot be reached on account of ice. It will be as much of a task to reach this pole as it will the true north pole.

If a magnetic needle were freely suspended, so as to point right and left in a horizontal plane (the compass needle) and up and down in a vertical plane (the dipping needle), and were carried northward, it would dip its north pole more and more toward the earth until it reached the area known as the north magnetic pole, when it would stand vertically, pointing directly downward to-

ward the earth. If it were carried beyond the magnetic pole directly toward the true pole it would assume more of a horizontal position.

The theory of the law of polar action, or the general law of magnetism (attraction and repulsion) was established long before the north magnetic pole was discovered. It was upon this advanced theory that an expedition was sent in search of this pole. It was reasoned upon the hypothesis that since all natural magnets had two poles of opposite character and a region deficient in magnetism between them (called magnetic equator), that the earth, too, must be a magnet with its magnetism distributed over its surface similar to that of an ordinary bar magnet. They reasoned that if the earth were a magnet it must have magnetic poles the same as other magnets, and since all suspended magnets pointed somewhere near to a north and south line, and the region comprising the higher latitudes of the Atlantic had been sailed over by compass with the result that the compass pointed near to such a line, it was concluded that one of the poles of the earth's magnetism was located somewhere in the far north. From the fact that the needle pointed to one side of the true meridian it became self-evident that this magnetic pole was not identical with the true pole, but must be some distance from it. Various observations with the dipping needle had been taken in England and on the Atlantic ocean previous to the time the pole was discovered, with the result that it further substantiated the theory that the earth was a magnet. The same thing was true of the magnetic equator. If the earth is a magnet having two poles, it must also have a dividing line separating the two kinds of magnetism, the same as any magnet. The theory was that on this line there would be no magnetic vertical force to give the dipping needle action, but that it would be controlled wholly by the horizontal force; thus it would assume a horizontal position the same as the horizontal compass needle. The magnetic equator was afterwards very accurately traced by means of the dipping needle, and was found very much as the theory advanced. The magnetic equator is a sinuous curve encircling the earth. The earth's magnetism is very unevenly distributed over its surface. This irregularity is no doubt due to the irregular shape of the earth. Every magnet has a magnetic field. The magnetic field is the entire space through which a magnet exerts its influence. A bar magnet, which is regular in shape, will have a magnetic field that is regular. The earth's magnet field is shown by the devious course of the lines of equal declination on the chart.

A magnetized needle, accurately balanced before magnetizing, when supported at the center and free to move vertically in the plane of the magnetic meridian, takes a position very much inclined to the horizon. A needle of this kind is called a dip-needle. At the magnetic equator the dip-needle is nearly horizontal. In the northern hemisphere the north end of this needle dips in going north, and in general the dip is greater the higher the latitude. The theory of the earth's magnetism can be proven by an ordinary bar magnet and a small magnetic needle suspended by a thread. In the first place this suspended needle, if not brought too close to the bar magnet, will always point in the direction that the bar magnet lies in. At the center of the bar magnet this dipping needle will assume a horizontal position no matter how close they are brought to each other. This shows the action of a dip-needle on the magnetic equator. If the suspended needle is carried toward either end of the magnet it dips more and more until the end is reached when it points vertically.

On the earth the greater the dip of the needle, the less the horizontal force acting on the compass needle to turn it into the magnetic meridian. In a region where the dip is 90 degrees, or the needle points vertically, there is no horizontal directive influence of the earth on the compass needle and it takes any direction indifferently; hence the compass needle has no action near the magnetic poles unless a weight is attached to the card to counteract the effects of dip.

LONG.

QUESTIONS FOR OILERS AND WATER-TENDERS—NO. 3.

21. In case of an emergency you were left in charge of an engine room at sea, your feed pump gave out and inspirator would not supply boilers, what would you do?

22. Should a duplex feed pump stop, name three places in rotation where you would first seek the trouble.

23. Upon examination you found the steam gauges out of order and trying the safety valves found them stuck, how could you readily ascertain the steam pressure you were carrying?

24. A pump having four (4) inch plungers and 225-lb. steam pressure per sq. in., what diameter must the steam pistons be to pump against 500-lb. pressure?

25. Why do some pumps O. B. ship have larger steam pistons in proportion to their diameter of plungers than others?

26. What is an air chamber to a feed pump, and where should it be located?

27. How does an inspirator force water into a boiler against its own head of steam?

28. What effect would the partly closing of the steam valve to water column have on the water level?

29. According to your judgment, what apparatus O. B. ship requires the most attention and care?

30. A horizontal tank 5 ft. square and 8 ft. long having a funnel-shaped bottom, is 2-3 full of water. Top of tank is 21 ft. above the water end of pump. What pressure per sq. in. will be on the under side of suction valve 6 in. in diameter discharge pipe situated in center of bottom of tank and 3 in. in diameter?

QUESTIONS FOR MASTERS AND MATES—NO. 6.

86. What is loadstone?

87. What is the natural magnet?

88. What kind of a magnet is the magnet of the compass?

89. In which direction does the magnetic needle point and to where does it point?

90. Do all magnetic needles point the same in the same place and at the same time?

91. What kind of iron is soft iron? What is its magnetic condition?

92. What is hard steel? What is its condition magnetically?

93. Does soft iron retain its magnetism?

94. Does hard steel retain its magnetism?

95. What is induced magnetism, or magnetism by induction?

96. What are the different methods of making magnets?

97. How would you go about to make a magnet for yourself?

98. In magnetizing a needle by the method of single touch, how do you know which is the north or south end of the magnet that received the rubbing?

99. Supposing you wanted the eye-end of a needle to be the north pole, and the point the south pole, which end of the rubbing magnet would you employ?

100. How do you determine the north and south poles of a magnet?

QUESTIONS FOR WHEELSMEN AND WATCHMEN—NO. 7.

Give all shoals and principal landmarks passed on either hand. In taking courses to make good the correct magnetic course you should take mean variation from point of departure to destination.

72. How does Scotts' Point can

buoy bear from Green Island lighthouse?

73. How does Niagara Reef gas buoy bear from Green Island lighthouse?

74. How would you enter Maumee straight channel?

75. How is Maumee straight channel marked?

76. What ranges do you steer on in Maumee straight channel?

77. At the intersection of Manhattan Ranges and Maumee straight channel inner gas buoy, what do you steer for?

78. What mark have you to know when to haul for Hocking Valley R. R. coal and ore dock?

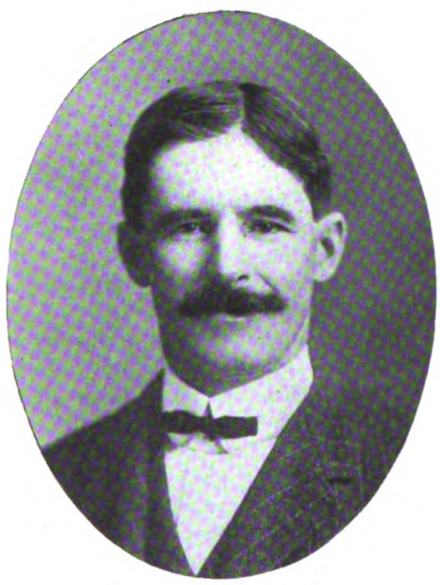
79. If approaching Southeast shoal bound up from eastward and can't locate Southeast shoal lightship, how would you know when to haul in safety?

80. How far is it from Southeast shoal lightship to Middle Ground lighthouse?

81. What is the correct magnetic bearing of Middle Ground lighthouse from Southeast shoal lightship?

CAPT. R. C. PRINGLE.

Capt. R. C. Pringle, who is master of the steamer Aurania, has made an excellent record as skipper of that record-



CAPT. R. C. PRINGLE.

breaking boat. He has an entire crew that works with one accord. The Aurania can do a round trip from Buffalo to Duluth loaded both ways on less than 150 tons of coal. Capt. Pringle is a fine type of the younger generation of mariners.

The Hercules Chain Co., Lebanon, Pa., has been incorporated to make marine chain.

BRITISH NAVAL PROGRAM.

A parliamentary white paper has just been issued containing a memorandum explanatory of the program of new construction for 1905-1906, with details not included in the navy estimates for 1906-1907. It is explained that the board of admiralty, having approved of the leading principles to be embodied in the various classes of vessels, appointed a committee of naval and scientific experts of large and varied experience as an advisory board to assist them in coming to a conclusion upon various important features in connection with these types. In the instructions to the committee it was clearly stated that it was "no part of the function or purpose of the committee to relieve the director of naval construction of his official responsibility for the design of the ships."

Having carefully examined and discussed various types of battleships and armored cruisers, and having had six alternative designs of each class under consideration, the committee unanimously decided to recommend the designs which, after the conclusions of the committee had been further discussed with the commander-in-chief of the channel and Atlantic fleets in January, 1905, and concurred in by them, were ultimately adopted. The principal dimensions of the designs, together with those of the destroyers, are shown in a table in the form usually submitted to parliament with the navy estimates.

The principal features of the Dreadnought design which has now been built to are as follows:

Armament—Ten 12-inch guns and twenty-seven 12-pounder quick-firing anti-torpedo boat guns, and five submerged torpedo tubes.

In arranging for the uniform armament of 12-inch guns, it became at once apparent that a limitation to the number of guns that could be usefully carried was imposed by considerations of the blast effect of the guns on the crews of those guns adjacent to them. It is obviously uneconomical to place the guns in such relative positions that the blast of any single gun on any permissible training should very seriously hamper the use of one or more of the remaining guns. While it is recognized that broadside fire is held to be the most important on a battleship, all-round fire is also considered of great importance, since it lies in the power of an enemy to force an opponent who is anxious to engage to fight an end-on action.

In the arrangement of armament adopted six of the guns are mounted in pairs on the center line of the ship, the remaining four guns are mounted in pairs on the broadside. Thus eight 12-inch guns (eighty per cent of the main armament) can be fired on either broadside, and four, or possibly six, 12-inch guns (or sixty per cent of the main armament) can be fired simultaneously ahead or astern.

In view of the potentialities of modern torpedo craft, and considering especially the chances of torpedo attack towards the end of an action, it is considered necessary to separate the anti-torpedo boat guns as widely as possible from one another, so that the whole of them should not be disabled by one or two heavy shells. This consideration led the committee to recommend a numerous and widely distributed armament of 12-pounder quick-firing guns of a new design and greater power than those hitherto carried for use against torpedo craft.

In order to give the ship good seagoing qualities and to increase the command of the forward guns a forecastle is provided, giving the ship a freeboard forward of 28 ft.—a higher freeboard than has been given to any modern battleship.

The main armor belt has a maximum thickness of 11 in., tapering to 6 in. at the forward and 4 in. at the after extremity of the vessel. The redoubt armor varies in thickness from 11 in. to 8 in., the turrets and fore-conning tower are 11 in. thick, and the after-conning tower is 8 in. thick. The protective deck varies from 1¾ in. to 2¾ in. in thickness.

Special attention has been given to safeguarding the ship from destruction by under-water explosion. All the main transverse bulkheads below the main deck (which will be 9 ft. above the water line) are unpierced except for the purpose of leading pipes or wires conveying power. Lifts and other special arrangements are provided to give access to the various compartments.

Mobility of forces is a prime necessity in war. The greater the mobility the greater the chance of obtaining a strategic advantage. This mobility is represented by speed and fuel endurance. Superior speed also gives the power of choosing the range. To gain this advantage the speed designed for the Dreadnought is 21 knots.

The question of the best type of propelling machinery to be fitted was also most thoroughly considered. While recognizing that the steam turbine system of propulsion has at present some disadvantages, yet it was determined to adopt it, because of the saving in weight and reduction in number of working parts and reduced liability

to break down, its smooth working, ease of manipulation, saving in coal consumption at high powers, and hence boiler-room space, and saving in engine-room complement, and also because of the increased protection which is provided for with this system, due to the engines being lower in the ship, advantages which much more than counterbalance the disadvantages. There was no difficulty in arriving at a decision to adopt turbine propulsion from the point of view of seagoing speed only. The point that chiefly occupied the committee was the question of providing swift stopping and turning power for purposes of quick and easy maneuvering. Trials were carried out between the sister vessels Eden and Wavêney and the Amethyst and Sapphire, one of each class fitted with reciprocating and the other with turbine engines. Experiments were also carried out at the admiralty experimental works at Haslar, and it was considered that all requirements promise to be fully met by the adoption of suitable turbine machinery, and that the maneuvering capabilities of the ship, when in company with a fleet or when working in narrow waters, will be quite satisfactory.

The necessary stopping and astern power will be obtained by astern turbines on each of the four shafts. These astern turbines will be arranged in series, one high and one low pressure astern turbine on each side of the ship, and in this way the steam will be more economically used when going astern, and a proportionally greater astern power obtained than in the Eden and Amethyst.

The ship has a total coal bunker capacity of 2,700 tons, and with this amount of coal she will be able to steam about 5,800 sea miles at an economical speed and about 3,500 sea miles at 18½ knots, after allowance has been made for bad weather and for a small amount of coal being left in the bunkers. Stowage for oil fuel has been arranged for, but oil fuel has not been taken into account in estimating the radius of action, which, of course, will be greatly increased thereby.

Considerable attention has been devoted to the arrangements for the accommodation of the officers and men. In view of the increasing length and greater power of modern ships, the usual position of the admiral's and the captain's quarters right aft is becoming more and more open to objection. Up to the present the principal officers have been berthed at the furthest possible distance from the fore bridge and conning tower, where their most important duties are performed. It has been decided that in this ship the admiral's and captain's quarters shall be placed on the main deck forward near the conning tower, also that the officers' quarters shall be placed forward, both on the main deck and on the upper deck in the fore part of the ship. Ample accommodation for the remainder of the crew is available on the main and lower decks aft.

100-TON ELECTRICALLY-OPERATED TOWER CRANE AT DUBLIN.

There has recently been erected in Dublin harbor, Ireland, an electrically-operated tower crane, which under normal conditions has a capacity of 100 tons, but is capable of carrying loads up to 150 tons as a maximum. The crane was built by the Vereinigte Machinenfabrik, Augsburg and Machinenbaugesellschaft at Nurnberg, Germany. It is lighted by incandescent lamps, the current being supplied for this purpose, as well as for operating the electrical motors, from a direct current circuit of 500 volts' pressure. Expressed in metric measure, the crane is capable of carrying a load of 20,000 kilograms, with a maximum radius of 80 ft., and 150,000 kilograms at 75 ft. It will raise loads of 100 tons to a height of 100 ft., and at a speed of five feet per minute. The hoisting speed is increased to 10 ft. per minute with a load of 50,000 kilograms, and to 20 ft. per minute with a load of 20,000 kilograms. The trolley moves along the crane at a speed of 28 ft. per minute, while a complete revolution of the enormous structure is made in about eight minutes. The electrical equipment was installed by Messrs. Siemens Brothers & Co., Ltd., of London. Automatic brakes are provided, which are controlled by electro-magnets and make the operation of the crane safe and reliable. The large boilers as well as the heavy parts of the electrical generators and high power reciprocating engines of the Dublin municipal electric lighting plant were all handled by this crane, being transferred from the ship to the docks by means of this labor-saving device during the recent construction of this important Irish electric station.

100-TON TOWER CRANE AT DUBLIN.

The new Southern Pacific steamship Monus was launched at Cramp's yard, Philadelphia recently. The Monus is a combined passenger and freight steamer of the following general dimensions: Length, 440 ft.; beam, 53 ft.; depth, 37 ft. Her engines are triple-expansion, supplied with steam from three double-ended and four single-ended Scotch boilers. She is intended for a speed of 17 knots and will ply between New Orleans and New York. She has a cargo capacity of 4,000 tons with refrigeration for 100 tons of perishable freight. Two sister ships of the Monus, the Creole and Antilles, are under construction.

The new Clyde liner Katahdin was launched from Cramp's ship yard last week and was named by Miss Abbie Hagerty. The Katahdin is 283 ft. long, 40 ft. beam and 29 ft. nine inches deep.

JAMES INMAN.

James Inman, chief engineer of the whaleback steamer Alexander McDougall for the past two seasons, is one of the younger generation of bright men who watch over the after end of the boats. He has sailed since he was 17 years of age, starting his career as a tug fireman at Chicago. At twenty he had his papers and he was in a second engineer's berth. Since then he has been making a name for himself by doing brilliant work.

Mr. Inman sailed as second engineer back in the nineties on the Bulgaria, Caledonia, Maryland and John W. Gates. His connection with the I. O. T. company covered a period of seven years. He was on the Maryland most of that time and men who sailed on that boat at the same time he did delight in telling of his record there. It was when the Maryland stranded in a fog at Whitefish Point that he particularly distinguished himself.

The Maryland went on the sandy bottom rather hard just west of Whitefish Point and had not been there long when a heavy nor'wester came up. A few hours more and the seas worked the sand out forward and aft, leaving her on amidships. The steamer twisted herself badly and the crew expected she would break in two when Mr. Inman came on watch and did things.

There were two life-saving crews alongside all the time and no one thought but that they would be needed. There was room for other calculations, however. A faithful and hard-working fireman was selected to go in the fire hold and the orders were to keep the fires burning so that she could have all the steam she wanted. The fireman stood by with his coal-passer and the ship fairly jumped off the sand bar. To this day Inman won't tell how much steam did the trick.

This is only one of many notable instances where Inman saved property and lives by forgetting any such word as fear. His shipmates can tell many more and they all reflect highest credit on him.

WHALEBACK ALEXANDER McDOUGALL.

With so much talk going on about the new and modern ore carriers, it is interesting to note that the whaleback steamer McDougall is in a class by herself so far as records go. With an apparent hoodoo attached to her before, she has done wonders in the past two seasons; in fact, so well the hoodoo has disappeared.

The McDougall is a quadruple expansion pipe boiler boat and it used to be that deck hands and firemen would shun her as they would a plague. She had a record for eating up coal and never doing better than a certain moderate speed. Today she averages about 250 tons of fuel on a round trip and she knocks off thirteen and a half miles easily.

The McDougall made three round trips in twenty-four days this summer, towing a barge up to Duluth on one of them. She made two and a half trips from Lake Erie to Lake Superior ports and a half trip to South Chicago. She started July 4 at night and reached South Chicago, July 28. She also made a seven-day trip from Ashtabula to Duluth and back.

Capt. John Nahrstedt is master of the McDougall, A. Collins being mate and Harry Ashby second mate. James Inman is chief engineer, with Guy W. Webb and George Emery as his first and second assistants. Duncan McDonald is steward.

CAR FERRY SOLANO.

The steamer Solano, the largest ferryboat in the world, crosses the Straits of Carquinez, carrying the trains of the Southern Pacific between Port Costa and Contra Costa county and Benecia, Solano county, Cal. She was built in 1879 and launched in November of the same year. Her construction resembles that of a huge scow, stiffened lengthwise by four wooden trusses, one under each of her four tracks. Her hull measures 64 ft. 10 in. in beam and 116 ft. eight inches over the guards. She is a double-ender with four balanced rudders at each end controlled by hydraulic steering gear. From a writer in the *Scientific American* we learn that the Solano is propelled by two simple walking beam engines of low pressure. Each engine has a 60-in. cylinder with an 11-ft. stroke, and its horsepower is 2,252. Each engine drives one wheel and works independently of the other. The wheels are 30 ft. in diameter and each has twenty-four buckets. The steamer has eight steel boilers, 24 ft. 10 in. long and 64 in. in diameter and carrying 40 lbs. steam pressure. Six of these boilers are in use every day. Once in three weeks two are laid off, when the scale that has accumulated is removed with crude soda. Petroleum is used for fuel. Every twenty-four hours 3,200 gallons are consumed. The tanks hold 8,300 gallons. It takes fifty minutes to fire up. The Solano has 424 ft. of deck length and is 406 ft. seven inches on her keel. Her registered tonnage is 3,549 tons. Approximately she has been handling 115,000 freight cars and 56,000 passenger cars a year. She is double crewed with seventeen men in each crew and runs day and night, making thirty-six to forty-six crossings in twenty-four hours. The length of her trip is one mile. The average time of transfer including time required to cut trains, place them on the boat, cross the straits, unload and couple on the other side, is about eleven minutes. Road engines handle one cut on and off the boat. A switch engine handles the other cut. The boat draws light six feet four inches, but draws 10 ft. seven inches when loaded. The hinged steel aprons weighing 190 tons over which the cars are transferred from the dock to the boat, are four track spans 100 ft. long. These are controlled by air-tight pontoons and counter-weights which are handled by hydraulic power from pressure pumps located on the boat itself, connection being made by means of pipes and ordinary air hose coupling. As the boat enters the slip the counterweights are raised by hydraulic power, leaving part of the apron unbalanced. This sinks the pontoon. The apron descends to the level of the deck. The end fits into a recess on the boat and is firmly latched down. The counterweights are released and the apron and the boat are free to rise and fall with the tide.

Considerable discussion has been aroused among naval officers over the publication in the "White Book," of London, of notes concerning the new battleship Dreadnaught and comparing this vessel with types now building for the United States navy. It seems from these reports that Great Britain has not a great deal the best of the United States as regards fighting points in the latest addition to the British navy. In comparison, the Michigan and South Carolina, now building, can fire eight 12-in. guns from broadside, the same as the Dreadnaught. The Dreadnaught can fire six 12-in. guns forward to the American's four. In broadside action all of the 12-in. guns on the American vessels can be handled, while the British can only use six. In speed the Dreadnaught has the advantage.

A dock, which is probably the highest in the world, has been completed at Port Florence, on the Victoria Nyanza, at an altitude of 3,800 ft. above sea level. It is intended to accommodate the Nyanza fleet plying on the lake in conjunction with the Uganda railroad. It measures 250 ft. in length by 48 ft. wide and 14 ft. deep. It was excavated out of solid rock by native labor, occupied twelve months in construction, and cost £4,000.

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National Metallic Packing

PATENTED IN U. S. AND FOREIGN COUNTRIES.

This packing is giving perfect satisfaction on all styles of rods on marine and stationary engines, locomotives and air compressors, and works perfectly on all sizes of rods from the highest to the lowest pressure. A glance at the above cut will show that the packing is arranged so that it adjusts itself to the rod and gives the rod a high polish and reduces the friction to a minimum.

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THOMAS B. BANNER, Marine Agent, 57 E. Kinzie St., Chicago, Ill.
DOWNEY & KRUSE, Marine Agents, Milwaukee, Wis.

"RAINO"
For Hard Service

"Raino" is a guaranteed absolutely waterproof cloth.

For ships' officers, yachtsmen, seamen, etc., it is the ideal waterproof garment.

"Raino" is very light, clean and neat looking. Far superior to either oilskins or rubber. It will not rot, nor is it stiff, heavy, oily or foul smelling.

After two years of the hardest kind of army and naval service tests in all parts of the world hundreds of officers declare it the most durable waterproof garment made.

"Raino" officer's Long Coat	$6.00
"Raino" Medium Coat	5.00
"Raino" Jacket	4.50
"Raino" Overalls	2.25
"Raino" Soft Squam Hat	1.00

Write for Samples and Price List P.

E. A. ARMSTRONG MFG. CO.
(Makers of the famous Armstrong Uniforms.)
Write for prices on Uniforms.
315-321 Wabash Ave., Chicago.

ARMSTRONG GUARANTEE.
A week's trial, Rain, Hose or Shower. If not satisfactory express back at our expense. Money returned. Show our faith.

LUNKENHEIMER
Brass "Pop" Safety Valves
POSITIVELY RELIABLE

VERY SENSITIVE TO EXCESSIVE PRESSURES

WILL NOT STICK, POUND OR LEAK

IF YOUR LOCAL DEALER CANNOT FURNISH THEM, NOTIFY US

The Lunkenheimer Co.

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"Otis" Fire Box Plates a Specialty.

STEEL CASTINGS FROM 100 TO 100,000 LBS.

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St. Louis: C. A. Thompson, 516 N. Third St
San Francisco: John Woodlock, 154-156 First St.
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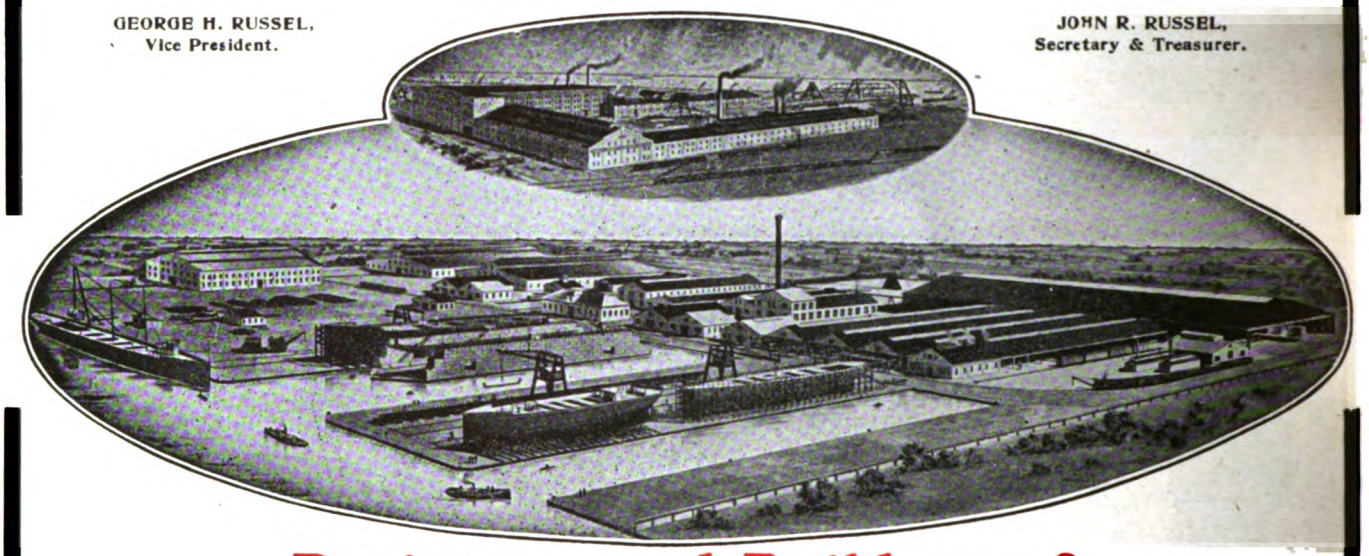
DETROIT, MICH.

ANTONIO C. PESSANO, President and Gen Mgr.

GEORGE H. RUSSEL, Vice President.

JOHN R. RUSSEL, Secretary & Treasurer.



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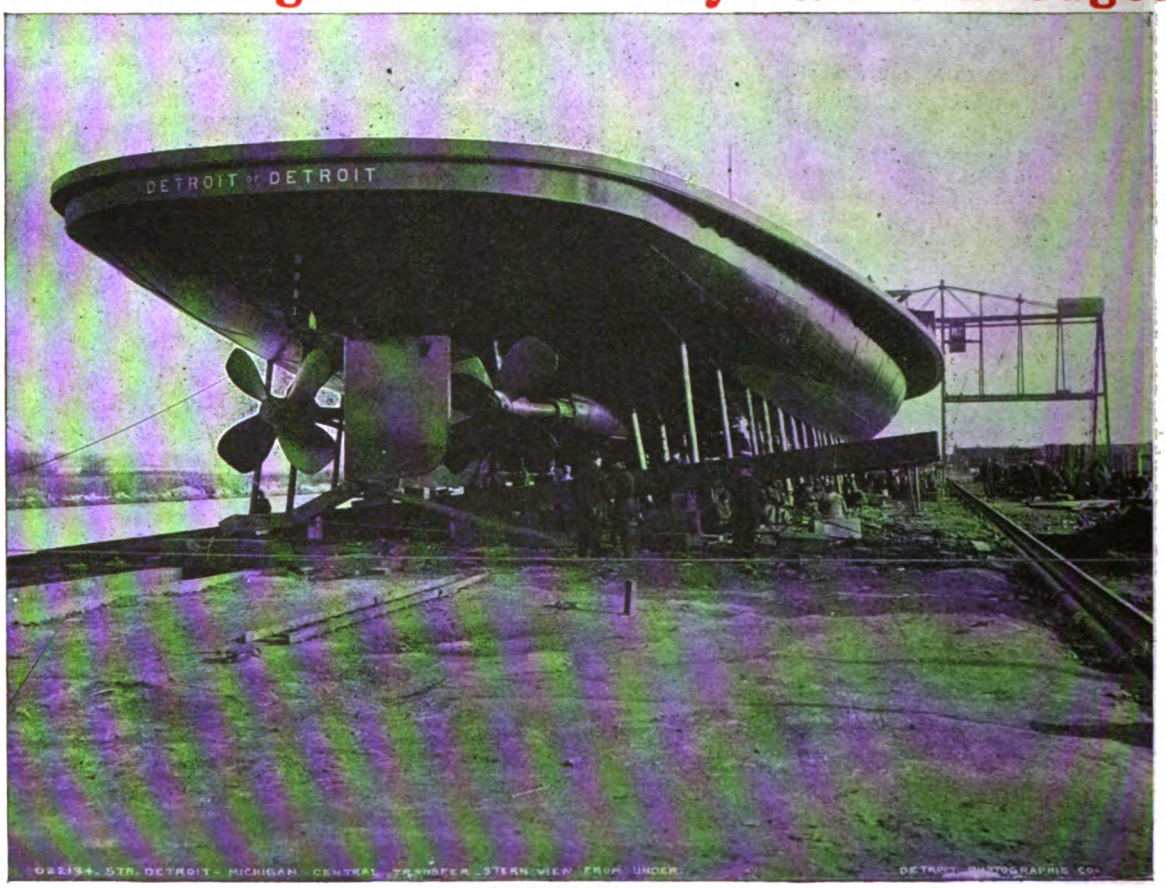

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ICE CRUSHING CAR FERRY "DETROIT"

304'-64'-19'6". Capacity—Thirty—40' Cars Loaded.

WANTED and FOR SALE

PROPOSALS.

U. S. Engineer Office, Jones Building, Detroit, Mich., Aug. 22, 1906. Sealed proposals for removing earth and boulders from Section 3, channel along Bois Blanc Range, Detroit river, will be received at this office until 2 p. m., Sept. 11, 1906, and then publicly opened. Information furnished on application. Chas. E. L. B. Davis, Col., Engrs.

FOR SALE.

Steamer T. S. Christie.

Length 160 ft.; beam 30 ft.; carrying capacity, lumber 525,000 ft., coal 800 tons. Rating in Inland Lloyds Register, A1½*, valuation $22,000. For price and particulars address Capt. P. Larsen, Box 249, Chicago, Ill.

For Sale, Tug Gladiator.

Length, 115 ft.; breadth, 22 ft.; depth, 12 ft. Steeple compound engine 22 x 42 x 30. Housed in forward. Tug can be seen under working conditions at Duluth, Minn., by applying to Split Rock Lumber Co., Duluth, Minn.

HAVE YOU

noticed how most people closely scan the "for sale" and "wanted" columns of their trade paper? Tell them through the MARINE REVIEW what you want or what you have for sale. They want to know. The cost is a trifle, $1 the inch. One dollar the minimum.

Low Rate Excursion to New York City. Lake Shore Ry.

August 28 and 29 the Lake Shore & Michigan Southern Ry. will sell excursion tickets to New York City and return at very low rates—practically a half fare—good for return leaving New York City until Sept. 4th, inclusive. Any particulars from Ticket Agent or by writing to J. W. Daly, C. A. G. P. A., Cleveland, Ohio.

FOR SALE.

Steamer for Sale Cheap.

The lighthouse steamer Haze, 145 ft. long, 27-ft. beam, 9-ft. draught, 500 tons capacity, 300 horsepower engine and boiler, suitable for passenger or freight business, fully equipped. Steam capstan, donkey boiler. Jacob Ullman, 46 Lloyd street, Buffalo, N. Y.

Steamer Hazel.

FOR SALE.—The passenger and freight steamer "Hazel." Length, 93 ft.; beam, 18 ft.; draught about 7 ft. 6 in. For further particulars address R. B. Rice, Grand Haven, Mich.

For Sale.

1,000 h. p. fore and aft Neafie & Levy compound Engine; surface condenser; independent pumps.
Two 12-foot Scotch Boilers.
One 13½-foot Scotch Boiler.
One 10 16-25 x 16 triple expansion Engine.
Three 150-h. p. Almy Boilers.
One 200-h. p. Tregurtha Boiler.
One 14 30 x 24 fore and aft Engine and condenser.
One Williamson steering Engine.
One 10 k. w. electric lighting Set.
One 15 k. w. electric lighting Set.
One Providence Windlass, 50 fathoms 1½ in. chain.
Two thrust Shafts and Bearings, 8½ in. diameter.

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Five Scotch Boilers, allowed 160 lbs, steam. Good as new. ERIE MACHINERY CO., 729 Garfield Bldg., Cleveland, O.

FOR SALE

Revolving or "Whirley" Derrick. In good order. Immediate possession.

Address:

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MAN WANTED near Cleveland, to show and assist us to sell properties. No experience necessary, if you are willing to let us teach you the real estate business. Salary $60.00 a month to start. Steady position to good man, who is willing to devote part of his time to handling customers. Address W. C. Cunningham, Andrus Bldg., Minneapolis, Minn.

INFORMATION WANTED regarding good farm for sale, with good title, somewhere near Cleveland. Give price, description and character of soil. Also state when possession can be had. Owners only, need answer. State how far from town. Address W. C. Cunningham, Andrus Bldg., Minneapolis, Minn.

Foreman Wanted.

First class General Steel Ship Building Foreman Experienced in large size freight steamers. Only First Class Mechanic with ability to handle men will be considered. Apply with references, Box 503, THE MARINE REVIEW, Cleveland, O.

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For a more complete classification than that represented by advertisers in The Marine Review, see the BLUE BOOK OF AMERICAN SHIPPING, Marine and Naval Directory of the United States, published by The Marine Review, Cleveland.

[See accompanying Index of Advertisers for full addresses of concerns in this Directory.]

AIR COMPRESSION, HOISTS.
Great Lakes Engineering Works....Detroit.

AIR PORTS, DEAD LIGHTS, ETC.
Marine Mfg. & Supply Co.....New York.

AIR PUMPS AND APPLIANCES.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.

ANCHORS.
Bowers, L. M. & Co.....Binghamton, N. Y.

ANTI-FRICTION METALS.
Cramp, Wm. & Sons....Philadelphia.

ARTIFICIAL DRAFT FOR BOILERS.
American Ship Building Co.....Cleveland.
Detroit Ship Building Co....Detroit.
Great Lakes Engineering Works....Detroit.

ASH EJECTORS.
Great Lakes Engineering Works....Detroit.

ATTORNEYS AND PROCTORS IN ADMIRALTY.
Gilchrist, Albert J.....Cleveland.
Goulder, Holding & Masten.....Cleveland.
Hoyt, Dustin & Kelley....Cleveland.
Jenkins, Russell & Eichelberger....Cleveland.
Kremer, C. E. .....Chicago.
MacDonald, Ray G.....Chicago.
Shaw, Warren, Cady & Oakes.....Detroit.
White, Johnson, McCaslin & Cannon.....Cleveland.

BAROMETERS, MARINE GLASSES, ETC.
Ritchie, E. S. & Sons.....Brookline, Mass.

BELTING (LEATHER.)
Republic Belting & Supply Co.....Cleveland.

BLOCKS, SHEAVES, ETC.
Boston Lockport Block Co.....Boston, Mass.

BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, David.....New York.
Marine Construction & D. D. Co..Mariner's Harbor, S. I., N. Y.
Truscott Boat Mfg. Co.....St. Joseph, Mich.

BOILER COMPOUNDS.
The Bird-Archer Co.....New York
Dearborn Drug & Chemical Works..Chicago.
Lake Erie Boiler Compound Co.....Buffalo
State Manufacturing Co...Cleveland.

BOILER MANUFACTURERS.
Almy Water Tube Boiler Co.....Providence, R. I.

BOILER MANUFACTURERS—Continued.
American Ship Building Co.....Cleveland.
Atlantic Works..East Boston, Mass.
Chicago Ship Building Co..Chicago.
Cramp, Wm. & Sons..Philadelphia.
Dearing Water Tube Boiler Co....Detroit.
Detroit Ship Building Co....Detroit.
East End Boiler Works....Detroit.
Fletcher, W. A. & Co.....Hoboken, N. J.
Fore River Shipbuilding Co.....Quincy, Mass.
Great Lakes Engineering Works....Detroit.
Kingston Foundry & Machine Works .....Oswego, N. Y.
Lake Erie Boiler Wks.....Buffalo
Maryland Steel Co.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....Milwaukee.
Mosher Water Tube Co..New York.
Newport News Ship Building Co..Newport News, Va.
New York Shipbuilding Co.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co.....Duluth, Minn.
Quintard Iron Works Co.....New York.
Roberts Safety Water Tube Boiler Co. .....New York.
Superior Ship Building Co.....Superior, Wis.
Taylor Water Tube Boiler Co....Detroit.
Toledo Ship Building Co.....Toledo.

BOILER RIVETS.
Bourne-Fuller Co.....Cleveland.

BOILER STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BRASS AND BRONZE CASTINGS.
Cramp, Wm. & Sons....Philadelphia.
Fore River Ship & Engine Co.....Quincy, Mass.
Great Lakes Engineering Works..Detroit.
Lunkenheimer Co.....Cincinnati.

BRIDGES, BUILDERS OF.
Scherzer Rolling Lift Bridge Co....Chicago.

BUCKETS, ORE AND COAL.
Brown Hoisting & Conveying Machine Co..... Cleveland.

CABIN AND CABINET FINISHING WOODS.
Martin-Barriss Co.....Cleveland.

CANVAS SPECIALTIES.
Baker & Co., H. H.....Buffalo.
Bunker, E. A.....New York.
Upson-Walton Co.....Cleveland.
Republic Belting & Supply Co....Cleveland.

CAPSTANS.
American Ship Windlass Co..... Providence, R. I.
Dake Engine Co.....Grand Haven, Mich.
Hyde Windlass Co.....Bath, Me.
Marine Mfg. & Supply Co.....New York.

CEMENT, IRON FOR REPAIRING LEAKS.
Smooth-On Mfg. Co.....Jersey City, N. J.

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Brown-Hoisting Machinery Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.

CHAIN HOISTS.
Boston & Lockport Block Co..... Boston, Mass.
Republic Belting & Supply Co.....Cleveland, O.

CHARTS.
Penton Publishing Co....Cleveland

CLOCKS (Marine and Ship's Bell) AND CHRONOMETERS.
Ritchie, E. S. & Sons..... Brookline, Mass.

COAL PRODUCERS AND SHIPPERS.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co....Cleveland.
Pittsburg Coal Co.....Cleveland

COAL AND ORE HANDLING MACHINERY.
Brown-Hoisting Machinery Co.....Cleveland.

COMPASSES.
Ritchie, E. S. & Son..... Brookline, Mass.

CONDENSERS.
Great Lakes Engineering Works.....Detroit.
Thropp & Sons Co., John E..... Trenton, N. J.
Wheeler Condenser & Engineering Co..... New York.

CONTRACTORS FOR PUBLIC WORKS.
Breymann Bros., G. H.....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co.....Buffalo.
Great Lakes Dredge & Dock Co.....Chicago.
Hickler Bros.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H.....Milwaukee.
Standard Contracting Co..Cleveland.
Sullivan, M..... Detroit

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Baker & Co., H. H.....Buffalo.
Upson-Walton Co.....Cleveland.

Buyers' Directory of the Marine Trade.—*Continued.*

CORK JACKETS AND RINGS.
Armstrong Cork Co..Pittsburg, Pa.
Kahnweiler's Sons, D....New York.

CRANES, TRAVELING.
Brown-Hoisting Machinery Co.....
.... Cleveland.

DIVING APPARATUS.
Morse, A. J. & Son.....Boston.
Schrader's Son, Inc., A..New York.

DREDGING CONTRACTORS.
Breymann & Bros., G. H....Toledo.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....
.... Buffalo.
Great Lakes Dredge & Dock Co..
.... Chicago.
Hickler Bros. .....
.....Sault Ste. Marie, Mich.
Hubbell Co., H. W..Saginaw, Mich.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M..... Detroit.

DREDGING MACHINERY.
Quintard Iron Works Co.New York.

DRY DOCKS.
American Ship Building Co.....
.... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Chicago Ship Building Co.....
.... Chicago.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co.....
.... Detroit
Great Lakes Engineering Works....
.... Detroit.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
....Milwaukee.
Newport News Ship Building Co...
.....Newport News, Va.
Shipowners' Dry Dock Co.Chicago.
Superior Ship Building Co.....
.... Superior, Wis.
Tietjen & Lang Dry Dock Co.....
..... Hoboken, N. J.
Toledo Ship Building Co.....Toledo.

DREDGE BUILDERS.
Manitowoc Dry Dock Co.....
..... Manitowoc, Wis.

DYNAMOS.
General Electric Co.....
....Schenectady, N. Y.
Thropp & Sons, John E.....
....Trenton, N. J.

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General Electric Co.....
.....Schenectady, N. Y.

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General Electric Co.....
.....Schenectady, N. Y.
Thropp & Sons, John E.....
.....Trenton, N. J.

ENGINE BUILDERS, MARINE.
American Ship Building Co.....
..... Cleveland.
Atlantic Works, East Boston, Mass.
Chicago Ship Building Co., Chicago.
Chase Machine Co.....Cleveland.
Cramp, Wm. & Sons, Philadelphia.
Detroit Ship Building Co., Detroit.
Fletcher, W. & A. Co., Hoboken, N. J.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

ENGINE BUILDERS—Continued.
Great Lakes Engineering Works....
..... Detroit, Mich.
Hall Bros. ..... Philadelphia.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Maryland Steel Co.....
.....Sparrows Point, Md.
Milwaukee Dry Dock Co., Milwaukee.
Mosher, Chas. D.....New York.
Newport News Ship Building Co....
.....Newport News, Va.
New York Ship Building Co.....
.....Camden, N. J.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Mich.
Quintard Iron Works Co., New York.
Roach's Ship Yard.....Chester, Pa.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....
..... Superior, Wis.
Thropp, J. E. & Sons Co.....
.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

ENGINE ROOM TELEGRAPH CALL BELLS, ETC.
Cory, Chas. & Son.....New York.
Marine Mfg. Supply Co., New York.

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Lunkenheimer Co. ..... Cincinnati.
Northwestern Steam Boiler & Mfg. Co. ..... Duluth, Minn.

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Hynd, Alexander ..... Cleveland.
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Kidd, Joseph.....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James ..... Cleveland.
Roelker, H. B.....New York.
Wood, W. J.....Chicago.

FEED WATER PURIFIERS AND HEATERS.
Ross Valve Co.....Troy, N. Y.
Wheeler Condenser & Engineering Co. ..... New York.

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General Electric Co.....
.....Schenectady, N. Y.

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..... Cleveland.
Fore River Shipbuilding Co.....
..... Quincy, Mass.

FLUE WELDING.
Fix's S. Sons.....Cleveland.

FUELING COMPANIES AND COAL DEALERS.
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Parker Bros. Co., Ltd.....Detroit.
Pickands, Mather & Co., Cleveland.
Pittsburg Coal Co.....Cleveland.
Smith, Stanley B., & Co.. Detroit.
Toledo Fuel Company, ...Toledo, O.

FURNACES FOR BOILERS.
Continental Iron Works, New York

GAS BUOYS.
Safety Car Heating & Lighting Co..
..... New York.

GAS AND GASOLINE ENGINES.
Chase Machine Co.....Cleveland.

GAUGES, STEAM AND VACUUM.
Lunkenheimer Co. ..... Cincinnati.

GAUGES, WATER.
Lunkenheimer Co.....Cincinnati, O.

GENERATING SETS.
General Electric Co.....
.....Schenectady, N. Y.

GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

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Chase Machine Co.....Cleveland.

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American Ship Building Co.....
..... Cleveland.
Brown Hoisting Machinery Co.....
..... Cleveland.
Chase Machine Co.....Cleveland.
Dake Engine Co.....
.....Grand Haven, Mich.
General Electric Co.....New York.
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Marine Iron Co.....Bay City.

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Falls Hollow Staybolt Co.....
.....Cuyahoga Falls, O.

HYDRAULIC DREDGES.
Great Lakes Engineering Works....
.... Detroit.

HYDRAULIC TOOLS.
Watson-Stillman Co., The.....
..... New York.

ICE MACHINERY.
Great Lakes Engineering Works....
..... Detroit.
Roelker, H. B.....New York.

INJECTORS.
American Injector Co.....Detroit.
Jenkins Bros.....New York.
Lunkenheimer Co. ..... Cincinnati.
Penberthy Injector Co.....
..... Detroit, Mich.

INSURANCE, MARINE.
Elphicke, C. W. & Co.....Chicago.
Gilchrist & Co., C. P.....Cleveland.
Hawgood & Co., W. A., Cleveland.
Helm & Co., D. T.....Duluth.
Hutchinson & Co.....Cleveland.
McCarthy, T. R.....Montreal.
McCurdy, Geo. L.....Chicago.
Mitchell & Co.....Cleveland.
Parker Bros. Co., Ltd.....Detroit.
Peck, Chas. E. & W. F.....
.....New York and Chicago.
Prindiville & Co.....Chicago.
Richardson, W. C.....Cleveland.
Sullivan, D. & Co.....Chicago.

Buyers' Directory of the Marine Trade---*Continued.*

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland, O.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co., Cleveland.

LAUNCHES—STEAM, NAPHTHA, ELECTRIC.
Truscott Boat Mfg. Co.....
.....St. Joseph, Mich.

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Armstrong Cork Co.....Pittsburg.
Carley Life Float Co.....
.....New York, N. Y.
Drein, Thos. & Son.....
..... Wilmington, Del.
Kahnweiler's Sons, D.....New York.

LIGHTS, SIDE AND SIGNAL.
Russell & Watson.....Buffalo.

LOGS.
Nicholson Ship Log Co., Cleveland.
Walker & Sons, Thomas.....
..... Birmingham, Eng.

LUBRICATING GRAPHITE.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

LUBRICATORS.
Lunkenheimer Co. ..... Cincinnati.

LUMBER.
Martin-Barriss Co. ..... Cleveland.

MACHINISTS.
Chase Machine Co.....Cleveland.
Hickler Bros., Sault Ste. Marie, Mich.
Lockwood Mfg. Co.....
.....East Boston, Mass.

MACHINE TOOLS (WOOD WORKING).
Atlantic Works, Inc....Philadelphia.

MARINE RAILWAYS.
Hickler Bros., Sault Ste. Marie, Mich.

MARINE RAILWAYS, BUILDERS OF.
Crandall & Son, H. I.....
.....East Boston, Mass.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York

MECHANICAL DRAFT FOR BOILERS.
American Ship Building Co.....
..... Cleveland.
Detroit Ship Building Co., Detroit.
Great Lakes Engineering Works....
..... Detroit.

METALLIC PACKING.
Katzenstein, L. & Co., New York.
The National Metallic Packing Co..
.....Oberlin, O.

MOTORS, GENERATORS—ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

NAUTICAL INSTRUMENTS.
Ritchie, E. S., & Sons.....
..... Brookline, Mass.

NAVAL ARCHITECTS.
Hynd, Alexander .....Cleveland
Kidd, Joseph .....Duluth, Minn.
Mosher, Chas. D.....New York.
Nacey, James .....Cleveland
Wood, W. J.....Chicago

OAKUM.
Stratford, Oakum Co.....
.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Joseph.....
.....Jersey City, N. J.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co...New York.
Robertson, Jos. L. & Sons.....
....New York.
The National Metallic Packing Co...
..... Oberlin, O.
Republic Belting & Supply Co.....
.....Cleveland, O.

PAINTS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

PATTERN SHOP MACHINERY.
Atlantic Works, Inc. ..Philadelphia.

PILE DRIVING AND SUBMARINE WORK.
Buffalo Dredging Co.....Buffalo.
Dunbar & Sullivan Dredging Co....
.... Buffalo.
Great Lakes Dredge & Dock Co....
.... Chicago.
Hickler Bros..Sault Ste. Marie, Mich.
Hubbell Co., H. W...Saginaw, Mich.
Parker Bros. Co., Ltd.....Detroit.
Smith Co., L. P. & J. A...Cleveland.
Starke Dredge & Dock Co., C. H...
....Milwaukee.
Sullivan, M.....Detroit.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland, O.

PLANING MILL MACHINERY.
Atlantic Works, Inc....Philadelphia.

PLATES—SHIP, STRUCTURAL, ETC.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

PRESSURE REGULATORS.
Ross Valve Co.....Troy, N. Y.

PROPELLER WHEELS.
American Ship Building Co.....
..... Cleveland.
Atlantic Works ..East Boston, Mass.
Cramp, Wm. & Sons..Philadelphia.
Detroit Ship Building Co....Detroit.
Fore River Shipbuilding Co.....
..... Quincy, Mass.
Great Lakes Engineering Works....
.... Detroit.
Hyde Windlass Co.....Bath, Me.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Milwaukee Dry Dock Co.....
....Milwaukee.
Newport News Ship Building Co..
.....Newport News, Va.
Roelker, H. B.....New York.
Sheriffs Mfg. Co.....Milwaukee.
Superior Ship Building Co.....
.....Superior, Wis.
Thropp & Sons Co., J. E.....
.....Trenton, N. J.
Toledo Ship Building Co.....Toledo.
Trout, H. G.....Buffalo.

PROJECTORS, ELECTRIC.
General Electric Co.....
.....Schenectady, N. Y.

PUMPS FOR VARIOUS PURPOSES.
Great Lakes Engineering Works..
.... Detroit.
Kingsford Foundry & Machine Works .....Oswego, N. Y.
Wheeler Condenser & Engineering Co. .....New York.

REFRIGERATING APPARATUS.
Great Lakes Engineering Works....
.... Detroit.
Roelker, H. B.....New York.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RIVETS, STEEL FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland, O.

RUBBER SUPPLIES.
Republic Belting & Supply Co.....
..... Cleveland, O.

SAFETY VALVES.
Lunkenheimer Co.....Cincinnati.

SAIL MAKERS.
Baker, Howard H. & Co....Buffalo.
Upson-Walton Co.....Cleveland.

SALVAGE COMPANIES.
See Wrecking Companies.

SEARCH LIGHTS.
General Electric Co.....
.....Schenectady, N. Y.

SHEARS.
See Punches, and Shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland, O.
Otis Steel Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....
..... Cleveland.
Atlantic Works ..East Boston, Mass.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons..Philadelphia.
Chicago Ship Building Co..Chicago.
Detroit Ship Building Co....Detroit.
Fore River Ship Building Co.....
....Quincy, Mass.
Great Lakes Engineering Works....
....Detroit.
Lockwood Mfg. Co.....
.....East Boston, Mass.
Manitowoc Dry Dock Co.....
.....Manitowoc, Wis.
Maryland Steel Co.....
.....Sparrow's Point, Md.
Milwaukee Dry Dock Co.....
..... Milwaukee.
Newport News Ship Building Co...
.....Newport News, Va.
New York Shipbuilding Co.....
.....Camden, N. J.
Roach's Ship Yard.....Chester, Pa.
Shipowner's Dry Dock Co..Chicago.
Toledo Ship Building Co.....Toledo.

SHIP CHANDLERS.
Baker, Howard H. & Co....Buffalo.
Marine Mfg. & Supply Co.....
..... New York
Upson-Walton Co.....Cleveland.

SHIP DESIGNERS.
Kidd, Joseph .....Duluth.
Steel, Nacey, & Hynd....Cleveland.
Wood, W. J.....Chicago.

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.....Cuyahoga Falls, O.

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1520 Rockefeller Bldg. CLEVELAND.

C. E. KREMER,
Counselor at Law and Proctor in Admiralty.
Suite 1505-1506-1507 Fort Dearborn Bldg.,
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RAY G. MACDONALD,
Attorney-at-Law and Proctor in Admiralty.
1018 Hartford Building,
Telephone, Central 2484 CHICAGO, ILL.

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